JUNE 1961 / 50c

AIR FORCE

and **SPACE DIGEST**

The Magazine of Aerospace Power / *Published by the Air Force Association*

OHIO STATE UNIVERSITY
MAY 29 1961

ASTRONAUT SHEPARD

Pioneer for Operational Man in Space

RESCUE

The Kaman HUSKIE was designed to be a rugged, reliable rescue helicopter. It was bred for the boondocks. The number, nature and difficulty of the rescues it has completed since entering operational service prove it was bred right. Rescues involving Kaman helicopters which hit the headlines recently follow below, with on the spot photos to the right.

A. LARSON AFB, WASH.— A Huskie hovering over the burning wreckage of a B-52D used its rotor downwash to keep flames away from the bomber's 128,000 pound fuel load until all 10 crewmen had been safely evacuated. (Air Force Photo)

B. CAPE HATTERAS, VA.— When the tanker Pine Ridge broke up off shore, a Kaman HUK operating from the Valley Forge rescued 9 crew members and returned them safely to its carrier base. (U.S. Coast Guard Photo)

C. RANDOLPH AFB, TEXAS USAF H-43 on standby alert reached the crash scene of a KC-97 tanker and worked with fire fighting crew to prevent flames from spreading to 4,000 gals. of spilled fuel, saving the aircraft. (San Antonio Field Photo)

THE KAMAN AIRCRAFT CORP., BLOOMFIELD, CONN.

A.

B.

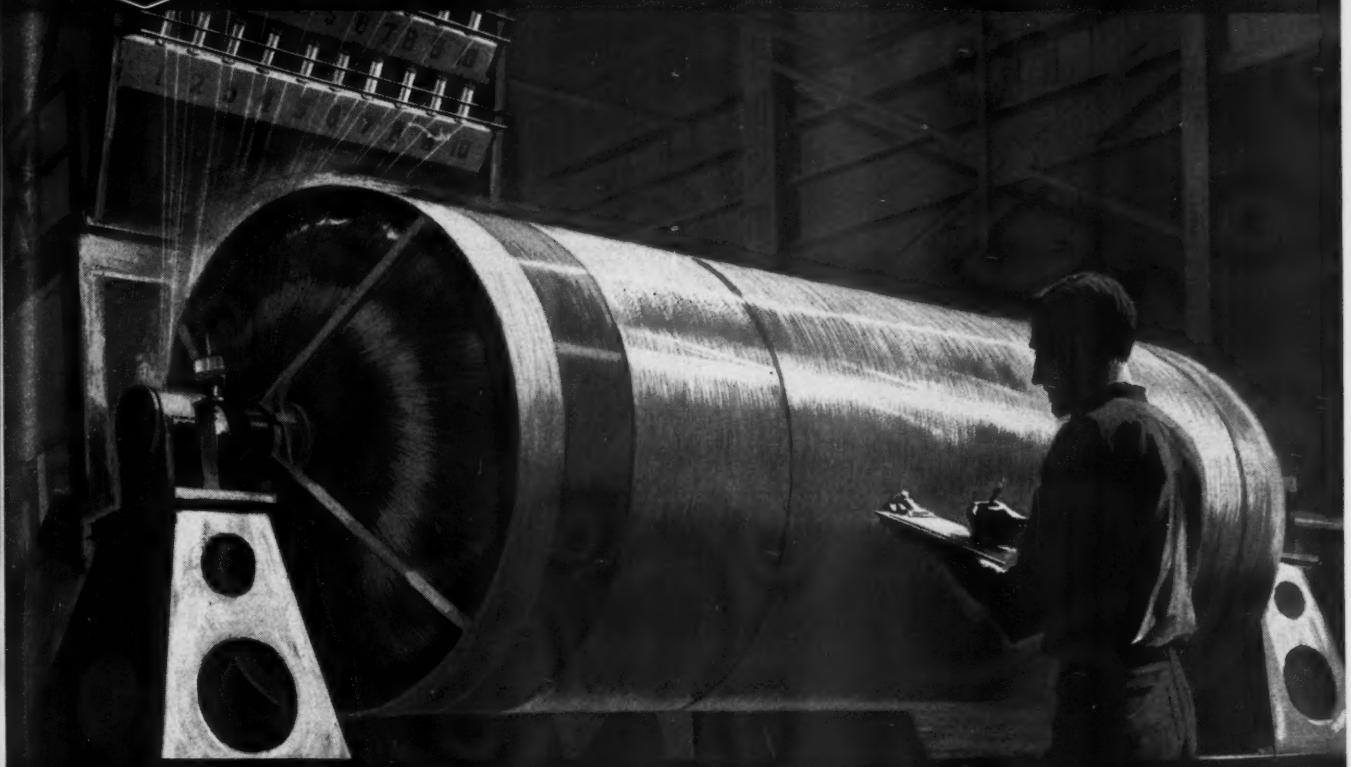
C.

In national defense
KAMAN is a part of the rescue plan

This demonstration photo became a reality at PLATTSBURG, N.Y., when one of the crewmen who bailed out of a crippled B-52 was injured when landing in an isolated area of 100 foot trees. The crew of a Huskie saved his life by hovering over the spot and lowering a medic to give first aid until rescuers on foot reached the scene.

GOODYEAR

FILAMENT WINDING: Another prime capability of Goodyear Aircraft



Polaris first stage filament-wound chambers are under development at Goodyear Aircraft. The weight advantage of glass filament over metal increases missile's range substantially.

NOW AT WORK... A BIG, NEW FILAMENT WINDER WITH SMALL-MACHINE PRECISION!

Capacity? Currently handles shapes up to 8′ x 24′; can easily be enlarged to 12′ x 36′. Precision? "On-the-nose" glass filament placement and indexing based on 421,575 computer-calculated pattern and index ratios. Wrap angles? Take your pick from 0° to 90°. Tensioning? To ounce-fractions.

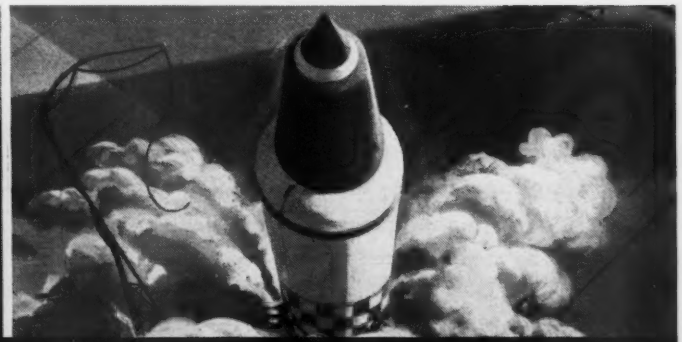
Virtually a quantum jump in winder capability, Goodyear's new machine was engineered to meet mushrooming requirements for bigger and stronger rocket motor cases. Impressive as its features are, they're matched by the step-ahead technology Goodyear has amassed in this fast-moving field. Typical example: An exclusive new quality control concept to provide continuous reliability checking from winder to launch pad. Details are yours for the writing. Goodyear Aircraft Corporation, Dept. 914VF, Akron 15, Ohio.

GOODYEAR

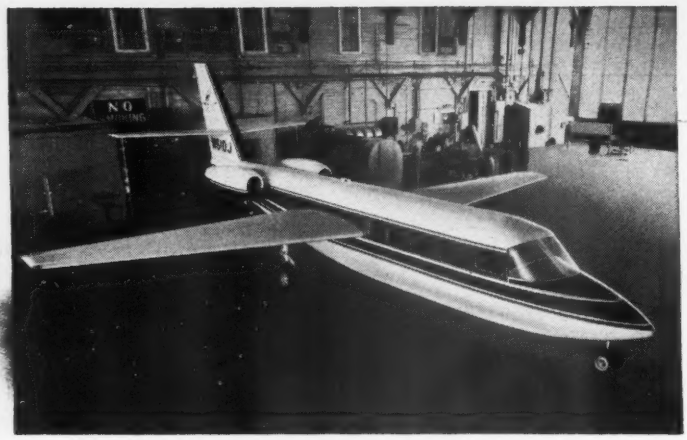
GOODYEAR AIRCRAFT CORPORATION

Plants in Litchfield Park, Arizona, and Akron, Ohio

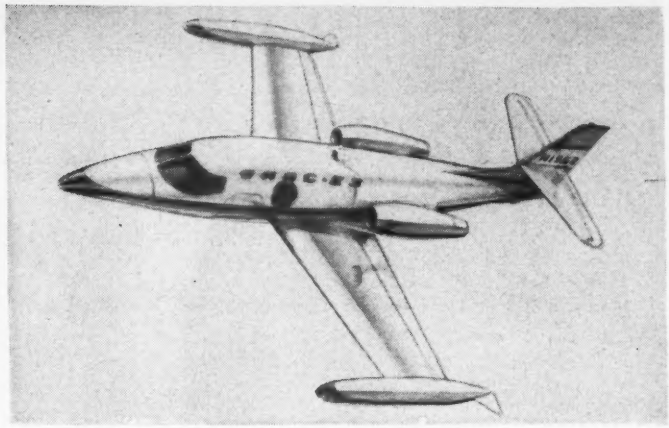
Underseas, GAC filament-wound components—with their high strength and light weight—can help solve a range of design problems.



Missile components such as nose cones and rocket nozzles can also be made lighter and stronger through GAC filament winding.



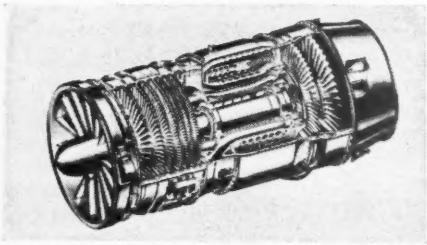
Aero Commander Model 1121



Swiss-American SAAC 23

CJ610 Selected to Power Executive Jet Aircraft

LYNN, Mass.—Twin General Electric CJ610 turbojet engines will provide power for new business aircraft recently announced by Aero Commander Inc., and Swiss-American Aviation Corp.



Simplicity of CJ610 design, which is nearly identical to the proven military J85, provides easy inspection, maintenance and disassembly.

The two six-to-eight place executive aircraft will bring Jet Age speed and improved range to the expanding corporate aircraft market.

Aero Commander's Model 1121, known as the "Jet Commander," and Swiss-American's SAAC 23, can cruise over the weather at speeds in excess of 500 mph. Their CJ610 engines, developed specifically for use in business aircraft, will enable both to operate from the same fields as those used by present-day propellor-driven aircraft.

Named as powerplant for the "Jet Commander," the CJ610-1 version produces 2850 lbs guaranteed thrust. The CJ610-2B, to be used in the SAAC 23, produces 2400 lbs guaranteed thrust.

Both versions are compact in design and measure 39.7 inches in length and 17.7 inches in diameter. Both will be FAA certified in 1961.

The CJ610-2B is also being used in studies by Israel Aircraft Industries as the powerplant for its B-101C executive jet.

Price of the CJ610 engines is lower than that of any comparable engines on the market.

The high performance CJ610 turbojet is one of the commercial derivatives of the proven military J85. With a history of nearly 30,000 test hours, the J85 has demonstrated versatility and reliability as the powerplant for Northrop's operational T-38 "Talon" trainer, McDonnell's GAM-72 "Quail" missile, now operational with the Strategic Air Command, Radioplane's Q4B supersonic target drone, and the experimental VTOL X-14A.

For additional information on the CJ-610 write for Bulletin GED-4451.1.

Convair 880: Three speed records, 1200-hou

CINCINNATI, O.—The 615 mph Convair 880 jet airliner helped three airlines set commercial speed records during its first year of scheduled service ending May 15, 1961.

The first speed record was claimed by Delta Air Lines during delivery of their initial 880. The aircraft raced the 2359 miles from San Diego to Miami in 3 hours 31 minutes to set a southern transcontinental speed mark. Average speed was 655 mph.

Last fall, an 880 destined for Northeast Airlines cut the 2730-mile "corner to corner" transcontinental record from San Diego to Boston to 4 hours, 10 minutes.

Most recently, Trans World Airlines joined the record setters when an 880 Superjet Flight set a commercial record of 2 hours, 57 minutes for the 1920 miles between San Francisco and Chicago. Scheduled time: 3 hours, 35 minutes.

In another first year development, the FAA recently granted Delta Air Lines a 1200-hour Time Between Overhaul for the General Electric CJ-805-3 turbojet engines powering the Delta 880 fleet. The authorization also included a TBO of 1500 hours for engine accessories and controls. The increase

TWA 880 Superjet hit 720 mph to set 1920-mile San Francisco-Chicago speed mark.

NEWS

A report about progress in research and products from the Flight Propulsion Division of the General Electric Company

30-Kw Plasmajet Engine Tested Successfully

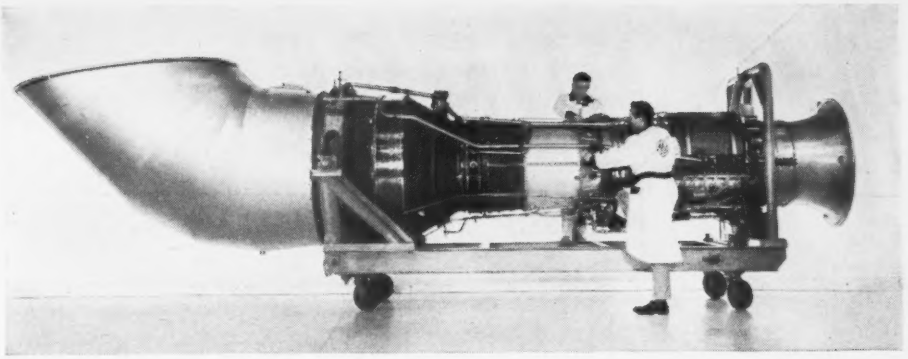
CINCINNATI, O.—A 30-Kw arc jet engine for space propulsion has successfully completed initial performance tests at General Electric's Flight Propulsion Laboratory.

Work on the engine is being performed for the National Aeronautics and Space Administration. This electric engine is designed to produce thrusts of the order of 0.5 lbs for extended periods of time, making it suitable for a number of functions in space.

Under another program—also being performed for NASA—General Electric is pinpointing the most attractive missions for this propulsion system, centering around lunar transfers, transfer to stationary satellite orbits and communication satellite installation functions. Power for this engine will be supplied by the SNAP VIII nuclear-turbogenerator system.

In principle, arc jets are similar to chemical rockets, except that the acceleration of mass is accomplished by an electrical energy input, rather than a chemical reaction. This allows the arc jet to operate at very high specific impulses, three to four times the value of chemical systems.

Because of its low propellant consumption, the electric power-propulsion system promises very significant increases in useful orbital payloads—with the boosters now under development.



Model 240 turboshaft is scheduled to power U.S. Maritime Administration 80-ton, 60-knot hydrofoil later this year. Dynamic Developments, Inc. is building the vessel.

Model 240 Engine Completes Tests; Goes to Grumman for MARAD Craft

CINCINNATI, O.—General Electric's Model 240 turboshaft engine, slated to power the U.S. Maritime Administration's 60-knot hydrofoil vessel in sea trials this summer, has completed qualification testing.

The engine produced over 18,000 shaft horsepower at 5500 rpm. All vibration levels were within design limits and turbine blade stresses were below limits for all normal operating conditions.

Following completion of the tests, the engine was shipped to Dynamic Developments, Inc., an affiliate of Grumman Aircraft Engineering Corp., at Babylon, N. Y. Dynamic Developments is under contract to deliver the 80-ton hydrofoil to MARAD this year.

G.E.'s Model 240 engine is part of a complete power package the Company is offering for marine propulsion. The package includes main powerplant, transmission, and docking engine.

The basic Model 240 engine is a turboshaft version of G.E.'s proven CJ-805 commercial turbojet. The basic engine weighs approximately 6600 pounds, only one-tenth as much as similarly rated reciprocating engines and steam propulsion systems.

General Electric's test facilities at Evendale, Ohio, where the Model 240 passed qualification, includes three water brakes capable of measuring 27,000 shaft horsepower. The Model 240 tests represented the first time such a system has been used with a large turboshaft engine.

engine TBO in first year

was granted in accordance with the FAA's Turbine Engine Time Control Program, which permits TBO extensions of 200 hours when engine shutdown rates of less than 1 per 10,000 flight hours are demonstrated.

Delta 880 averaged 655 mph, setting southern transcontinental speed record.

Northeast 880 cut "corner to corner" San Diego-Boston record to 4 hr, 10 min.

CJ-805-23C Certificated by FAA

CINCINNATI, O.—General Electric's CJ-805-23C aft-fan engine has been awarded Federal Aviation Type Certificate number 1E5.

The 16,100 pound thrust class CJ-805-23C will power the Sud Aviation Caravelle VII, scheduled to make its first flight in France late this year. General Electric has been flight testing a Caravelle with aft-fan engines installed since December, 1960.

FOR MORE INFORMATION

If you would like additional information on these G-E flight propulsion programs, write: General Electric Company, Section 206-28, Schenectady 5, N. Y.

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—NASA Photo

On these pages we've often pointed out that military people have long made significant contributions to the burgeoning astronautical field. We've noted, too, that—for political reasons to which we take exception—this fact has been muffled as if it were something to be ashamed of. This muffling, we think, is mostly due to a traditional belief in too many quarters that people in uniform, the best and the worst of them, are somehow a different and suspect breed apart. You'll recall that Brig. Gen. Sidney F. Giffin, USAF (Ret.), explored this problem incisively in his article, "The American Military Mind in a Strange New World," in our February '61 issue.

As we think back on the creditable performance of Navy Commander Alan B. Shepard, Jr., during his public appearances after the brilliantly successful manned ballistic flight, it occurs to us that beyond his brave feat he made another really important contribution to public understanding. For here is a man who, like his Air Force, Navy, and Marine colleagues in the civilian-run Astronaut program, has devoted most of his adult life to his country's service. Like the rest of us, he, too, takes his work seriously. And when there is a rare hour for relaxation, he, too, hopes for the privacy, the time with one's family, the moment to muse, that makes life worthwhile in a savage world.

As they watched him on television, many Americans, from the comments heard everywhere, must have felt that Commander Shepard was one of their own, no breed apart—just in a difficult and different line of work—actively helping defend the freedom and prestige of the free world.—W.L.

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Protecting Presidential Prestige / CLAUDE WITZE — AN EDITORIAL — 6

Rover—The Nuclear Way to Space / J. S. BUTZ, JR. — 36

A nuclear rocket would play an immensely important role in our space program. Such a rocket is under development in the NASA-AEC Project Rover. But, at present, fiscal problems stand in Rover's way.

USAF'S Paperwork Pipeline / COL. JAMES L. TARR, USAF (RET.) — 43

Gold may still be the sinew of war, but paperwork is its nervous system. The Air Force, determined not to get bogged down in a sea of paper, twisted in red tape, and buried under a mountain of memoranda, is taking energetic action in this vital area.

Yesterday's 'First Line of Defense' / MURRAY GREEN — 50

Dramatic advances in technology dating back to the Wright brothers have revolutionized modern weaponry. But our nation's defense organization has not kept pace. The US Navy has been at the forefront of those who oppose progressive defense reorganization.

SPACE DIGEST

Man in Space—A Time for Realism and Rededication / WILLIAM LEAVITT — 59

How purposeful and "broad spectrum" have our space efforts really been? Can we allow stand-patters and carpers to color falsely our view of the national record and needs?

Astronaut Shepard's Day . . . In and Out of Space / A PHOTO ESSAY — 62

For millions who watched the courageous Mercury Astronaut make his successful flight, there was a real sense of personal identification with the national space effort.

How America Viewed the News of Soviet Man in Space / DONALD N. MICHAEL — 67

An eminent social psychologist comments on indifference and disbelief evidenced by too many of us as the long-predicted Russian manned orbital journey came to pass.

Gagarin—A Tragedy for the Free World / WILLIAM V. SHANNON — 72

That an authoritarian regime, dedicated to the dismantling of freedom, should have written a now-ineradicable page in history is something for all of us to ponder sadly, writes one of the distinguished young political columnists of the day.

Yuri Gagarin's Scrapbook / A PHOTO ESSAY — 78

The day before his flight, the Red Cosmonaut was unknown to the world. After his feat, his likeness was broadcast to all Russia and the world, a tribute to the passion for secrecy and propaganda skills of our Soviet competitors.

Speaking of Space / WILLIAM LEAVITT — 82

Having criticized its predecessor's performance the new Administration now faces the acid test of its own astronautical intentions. There are indications of coming sizable spurts in our efforts.

Win, Lose, or Draw / RULES FOR A NEW GAME — 93

Whatever other "gaps" the free world may suffer from, we most assuredly have a home-strategy-game gap. Such a game, which would enable Americans to deal with major issues of war and peace over their kitchen tables, is within our reach.

Back in the Jug—After Twenty Years / FREDERIC M. PHILIPS — 118

May 2 marked the twentieth anniversary of the first flight of the P-47 Thunderbolt, or "Jug." Hundreds of wartime P-47 pilots commemorated the occasion at a nostalgic reunion in New York.

An Editorial

Protecting Presidential Prestige

Claude Witze
SENIOR EDITOR, AIR FORCE MAGAZINE

FEW Americans will dissent if we hold that President John F. Kennedy has rallied their support and sympathy in the wake of the Cuban blunder, which may well go down in history as one of the worst ever condoned by the White House. One of the important reasons for this appears to be the fact that the President shouldered the blame without a murmur. The actual fault, of course, lay with the men giving him facts and counsel, and the normal reaction of an executive in this situation would be to chop the responsible heads. There could have been blood on the floors of the Executive Office Building, the State Department, the Pentagon, and the cloistered quarters of the Central Intelligence Agency.

In many ways it is unfortunate that this decapitation did not take place. It is argued in Washington that Mr. Kennedy sees the Cuban affair as he does the other thorns in his side—the thorns in Laos and Berlin and Africa and all the other frontiers where communism is pressing. He has an avowed intention to solve the whole problem, not just little parts of it, and to panic over Cuba might jeopardize the major effort. On the other hand, there is no doubt the President recognizes the severe blow his prestige has suffered. He knows full well it is the President and the President alone who is vested with power to fit his responsibility in these situations. The people from whom he obtains advice do not share either this power or this responsibility. The awful mistake that was made in Cuba has been made, and the whole nation, we believe, including the millions who voted for Richard Nixon, wants to see Jack Kennedy make the recovery he deserves and America needs. If Mr. Kennedy thinks he can effect this recovery without sending some of his official family to the guillotine—in the sense, perhaps, that Harry Truman took care of Gen. Douglas MacArthur—that is another executive decision with which we will not quarrel.

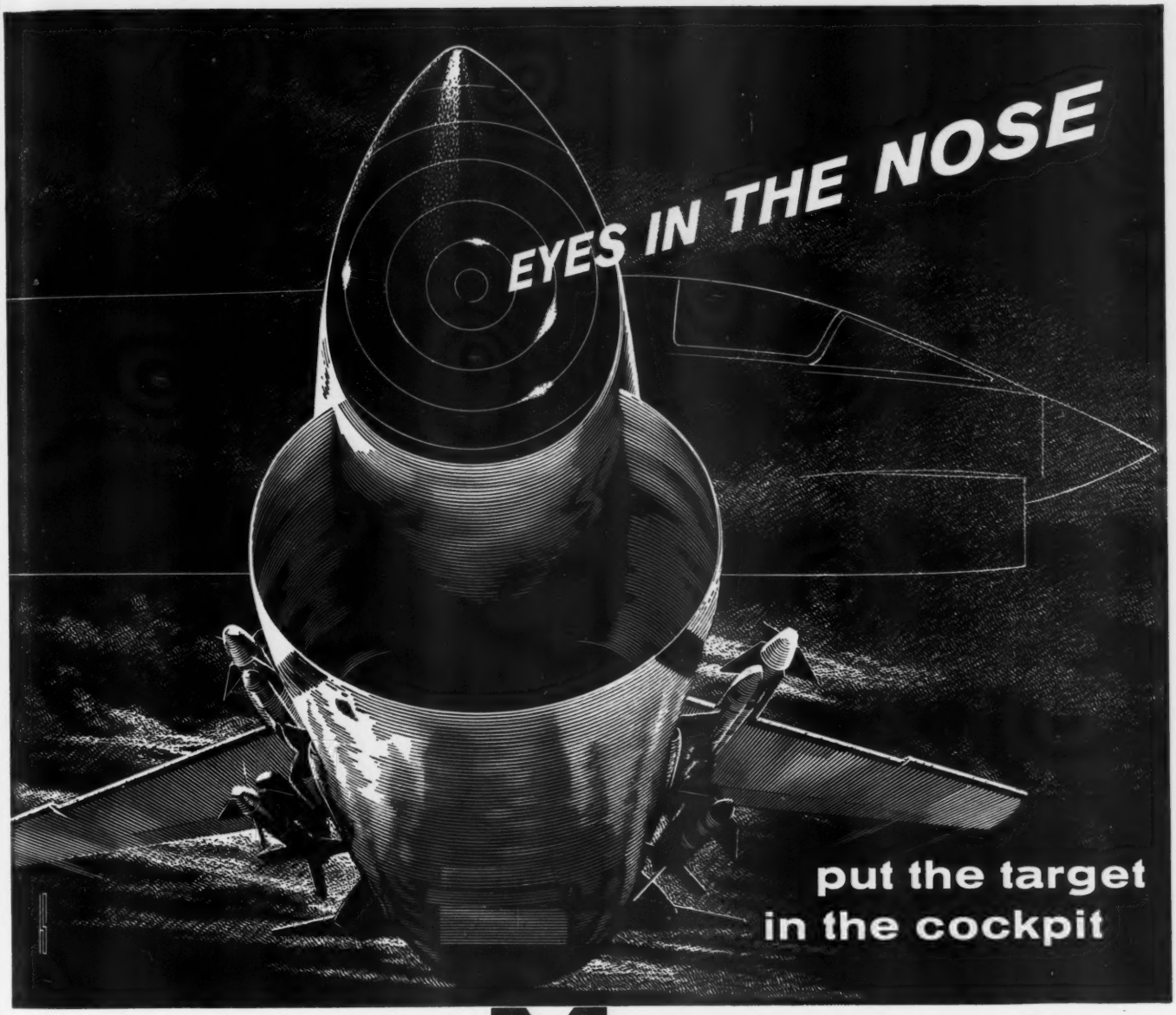
We cannot avoid the observation, at this time, that Mr. Kennedy is Commander in Chief of the Armed Forces of the United States. From where we sit, it is the greatest of his responsibilities, and it vests him with the most awesome of his powers. In the light of the Cuban experience, we believe it essential to point out that these powers and responsibilities are not shouldered by Defense Secretary McNamara or the Chiefs of Staff or Paul Nitze or McGeorge Bundy or Jerome Wiesner or anyone else in the military establishment, the State Department, or the White House. They are the powers and responsibilities of the Commander in Chief and his alone. In the crucial military decisions that are to come in the next four years, minus a hundred days, Jack Kennedy is going to face other and even sterner tests on which his national and world prestige will be in the balance again. If he makes wrong decisions, he is going to take the blame again, too. It will be the blame for all the information he has received, on which he makes decisions, even when that information is wrong, as it was in the Cuban affair.

For all of the praiseworthy steps that have been taken this year toward improving the management of the Defense Department, there is persistent evidence that professional military men are being downgraded in areas where their training and experience should be most valued. If this is true it follows that Mr. Kennedy, as Commander in Chief, is being insulated from professional military counsel. We submit that in 1961 this situation in itself is a menace to his recovery from the Cuban debacle and a peril to his national and world prestige in the future.

The President of the United States, armed with the unequaled power of that office, can turn down advice from any quarter. But this does not mean he should not listen to this counsel. If he is going to make a military decision, and he will make important ones in the role handed to him by the Constitution with many specifics, he will be making it from an intrinsically vulnerable position if he acts without the advice of professional soldiers, sailors, and airmen. His prestige, and that of the entire free world, cannot afford to hang by a cable from which this strand of military competence has been unraveled.

It is reasonably clear that we share our apprehension on this aspect of John Kennedy's future as President with many other people. There is a manifestation of this, we suspect, in the opinions of the House and Senate Armed Services Committees. Both of them have raised serious questions about the Kennedy decision, expressed in revisions of the Eisenhower defense budget, to downgrade the manned bomber and put almost sole future reliance on intercontinental ballistic missiles. Defending this heavy faith in the robot weapon, it will be recalled, the Pentagon did not cite a military authority, but quoted as "international experts in this field" two civilian directors of the Defense Department research and development setup.

When President Kennedy turns to the more esoteric areas of military concepts and strategy, further removed from simple questions about hardware and its reliability in the form of weapon systems, there can be even greater peril in complete reliance on nonmilitary or antimilitary intellects. We are not contending that the Commander in Chief must accept and follow the advice of his uniformed chiefs. We do argue that he should hear them and that what they say should have an opportunity to be a factor in his decisions. Without this input we have too little insurance against new blunders, new blame to be borne by the President, and new and insufferable blows to his prestige, and therefore to the prestige and influence of the nation.—END

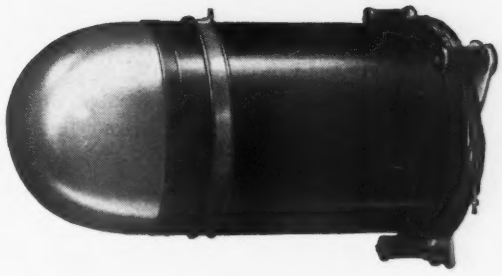


Magnavox

As a result of development by the Magnavox Company in conjunction with the Navy Department, every Chance Vought F8U-2N Crusader Fighter Pilot sees the target at a glance—day or night, in any kind of weather.

Here are the eyes of a modern weapons system . . . a component that delivers the range, weight and reliability so absolutely necessary to successful tactical operations.

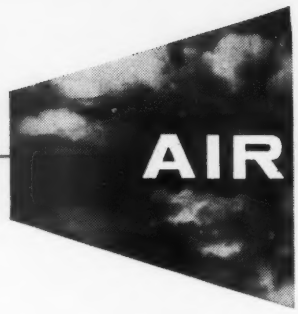
This airborne radar system is just one of many systems which have been and are being designed and produced to satisfy the tactical requirements of the military services in the fields of Communications, Airborne Radar, ASW, Navigation, Fusing and Data Handling.



AIRBORNE FIRE CONTROL RADAR

COMMUNICATIONS	RADAR	DATA HANDLING	ASW	MISSILES

THE MAGNAVOX CO. • DEPT. 403 • *Government and Industrial Division* • FORT WAYNE, IND.



Public Irresponsibility—Then and Now

Gentlemen: Dr. Edward Katzenbach's thesis "The Horse Cavalry: Monument to Public Irresponsibility," is brilliantly developed in the condensed version of his paper published in the January 1961 issue of AIR FORCE. Why was the US horse cavalry able to perpetuate itself? Because it drew support from the highest military authorities in the United States until the very eve of World War II. On May 20, 1937, Gen. Malin Craig, Army Chief of Staff, supported War Department budget requests before the Senate Appropriations Subcommittee. This exchange occurred:

SENATOR JOHN H. OVERTON (Louisiana): "Is it your opinion that the regiments of modern cavalry should be increased or should remain just as is contemplated in this bill."

GENERAL CRAIG: "If we had a war, Senator, we would have to increase them."

SENATOR WILLIAM GIBBS MCADOO (California): "Most people think that in a war the cavalry is pretty well relegated to the rear and is antiquated."

GENERAL CRAIG: "I personally do not think so."

SENATOR MCADOO: "I am just wondering if mechanized units are not superseding the cavalry."

GENERAL CRAIG: "Well, anybody who is familiar with the World War and is familiar with what the cavalry did then in the face of machine guns; with what General Allenby did in Palestine, capturing guns over open places without losses, with the history of cavalry on the Russian front, should not anticipate that cavalry is not needed in the modern army." *(Hearings, Senate Subcommittee on Appropriations on HR 6692 (1938), pp. 54-5).*

Over in the House, Representative Albert J. Engel (Michigan) had posed a pointed, four-worded question to Maj. Gen. Leon B. Kromer, Chief of Cavalry, and received this reply:

MR. ENGEL: "Is horsed cavalry obsolete?"

GENERAL KROMER: ". . . Can the modern iron horse supplant the animal horse in this lighter, more mobile element of the Army combat team, realizing that the missions assigned to this more mobile element in campaign will have to be performed in the future no matter what may be the means of transportation? These missions require this element to proceed over every type of terrain suitable for military operation, even though rough, wooded, or cut up by streams, and under all conditions of weather and light or darkness. Demolitions and abstacles [*sic*] at critical points on varied terrain can effectively delay the progress of vehicles, and if these critical spots are defended the advance will be stopped until the hostile resistance is reduced and the route made passable. In any conceivable terrain for large operations there will be plenty of such critical places which an enterprising enemy will utilize. No such hostile action will be equally effective against horsed cavalry.

"So, simply from the point of view of being able to move rapidly across country to all portions of the battle area, horsed cavalry must continue to be available in the Army combat team. . . ." *(Hearings, War Department Appropriation Bill, 1938, pp. 396-7).*

General Kromer's successor, Maj. Gen. John K. Herr, galloped forward without missing a stride. Two years later, on February 3, 1939, the new Chief of Cavalry was called up for testimony to justify a requested increase in his appropriation.

Representative Engel must have remained unconvinced by the extended rationale that he had been given in 1937. "What justification is there in the face of modern warfare," he asked General Herr, "for the existence of a cavalry unit in the Army. . . ?"

GENERAL HERR: "Justification for horse cavalry must rest on two pillars of support. The first pillar of support is that of historical facts concerning the use of horse cavalry in the World War . . . its use was vital and necessary, and that, even on the Western Front with its siege warfare, whenever movement was restored there was urgent need for cavalry.

"The second pillar of support is to show clearly that the airplane and motor cannot displace the cavalry by executing more effectively its historic missions . . . this is somewhat like considering a man guilty until he proves himself innocent when, as a matter of fact, there has been nothing except theory, conjecture, and peacetime maneuvers to uphold the thought that the horse cavalry which has stood the acid test of war may be displaced by elements which have not yet demonstrated their ability in the same acid test of war. . . ." *(Ibid, p. 480).*

One of the reasons, General Herr could have added, that US aviation had not been submitted to an acid test was the inability of General "Hap" Arnold and his associates to obtain suitable aircraft. In fiscal year 1938 a request for fifty B-17s was rejected by the General Staff. The Air Corps was told it had been "led astray by the allurement of a quest for the ultimate in aircraft performance at the expense of practical military need."

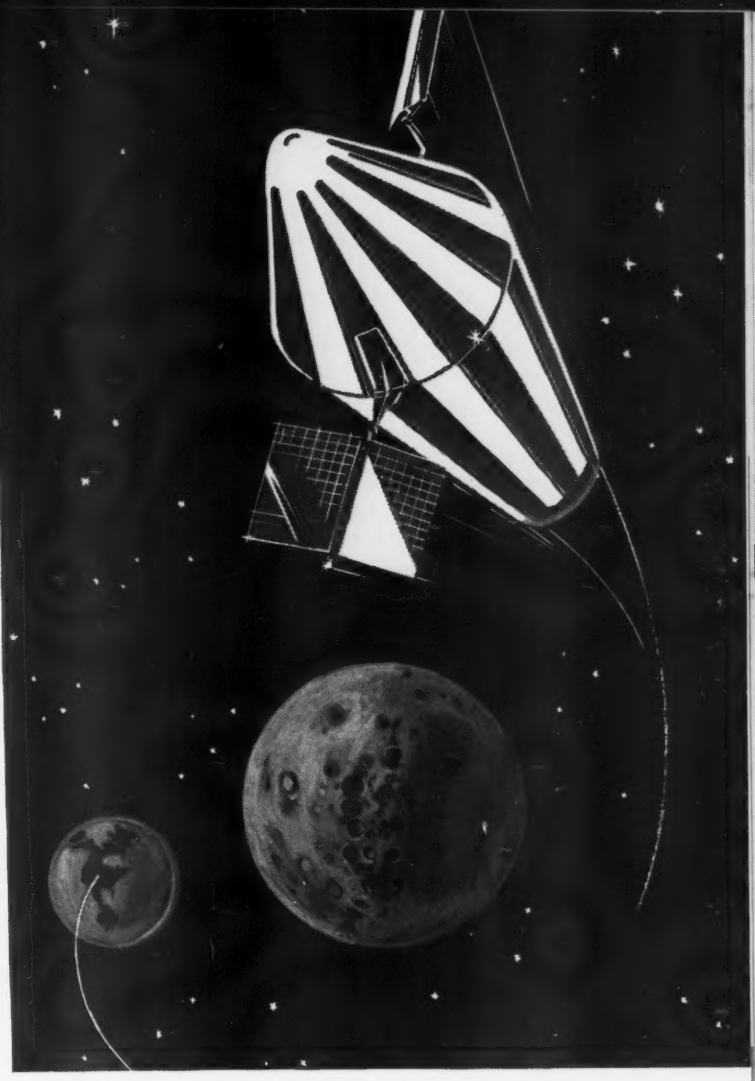
In the spring of 1938, Secretary of War Harry Woodring directed the Air Corps to confine its bomber estimates to light, medium, and attack types. And one year later, on the eve of World War II, when Adolf Hitler was already tuning up the motors of his *Panzergruppen* and *Wehrmacht*, the US Army Chief of Cavalry was publicly expressing this opinion: "I am convinced that American horse cavalry today constitutes the most effective highly mobile fighting force in the world for operations on the American continent or similar areas." *(Hearings, War Department Appropriation, 1940, p. 468).*

Fortunately, we survived World War II that followed, perhaps because we had more than two years to learn from the vicarious experience of watching hostilities in Europe, Africa, and Asia before becoming involved ourselves. By December 7, 1941, the US horse cavalry had been mercifully retired. . . .

The next time—if there is a next time—we certainly will not have the luxury of months, weeks, or even days to reshape the tools we need to

(Continued on page 10)

Wanted: More problems to solve with Beech "Imaginuity"



How can Beech put its facilities, manpower and experience to work on your project?

Over the years, as Beech Aircraft Corporation has constantly developed its capabilities in the fields of design, development, fabrication and testing, it has acquired equipment, skills and experience that has enabled Beech to make invaluable contributions to the solution of many challenging problems related to the missile and aerospace age.

Current projects of Beech Aerospace Division include R&D on manned aircraft; missile target and reconnaissance systems; complete missile systems; electronic guidance systems; programs pertaining to liquid hydrogen propellants and cryogenic tankage systems; environmental testing of missile systems and components; and GSE.

With this background, Beech is in a position to undertake many new projects in the missile and aerospace fields with the assurance of a "head start" toward their rapid and successful completion.

May we discuss how Beech can put its capabilities to work for you? Write, wire or phone Roy H. McGregor, Manager — Contract Administration, Beech Aircraft Corporation, Wichita 1, Kansas—or one of the offices listed below.

In which of these areas can Beech help you save time and money?

- ☐ CRYOGENICS
- ☐ MISSILE SYSTEMS
- ☐ MISSILE TARGET AND RECONNAISSANCE SYSTEMS
- ☐ MANNED AIRCRAFT
- ☐ SUPPORT EQUIPMENT
- ☐ RESEARCH AND DEVELOPMENT
- ☐ ENVIRONMENTAL TESTING
- ☐ _____

Beech Aerospace Division

BEECH AIRCRAFT CORPORATION • WICHITA 1, KANSAS.

WICHITA, KANSAS:
Mr. R. H. McGregor
Manager—Contract Administration
Beech Aircraft Corporation
9709 East Central
MUrray 3-4681

AREA OFFICES:

WASHINGTON, D. C.:
Mr. Wm. Mason Shehan
Manager, East Coast Area
Beech Aircraft Corporation
408-409 Universal Bldg.
ADams 4-6023

XENIA, OHIO:
Mr. Darrell L. Schneider
Mgr., Great Lakes & Midwest Area
Beech Aircraft Corporation
3530 Woodgreen Drive
BAldwin 3-5025, Dayton

BOULDER, COLORADO:
Mr. A. L. Clark
Manager, Engineering & Sales
Beech Aircraft Corporation
P. O. Box 631
Hillcrest 3-1650

ONTARIO, CALIFORNIA:
Mr. Howard E. Mers
Manager, West Coast Area
Beech Aircraft Corporation
1517 Amber Court
YUkon 6-5755

HUNTSVILLE, ALABAMA:
Mr. T. Bruce Cooper
Manager, Huntsville Area
Beech Aircraft Corporation
3313 Memorial Parkway
JEfferson 9-4631

win World War III. Therefore, we may properly ask: How much of our judgment and sense of proportion have we abdicated to service partisanship? Today there are being conjured up right before us contemporary equestrian specters by those who profess to see "a man on a white horse" when any attempt is made to appraise the current usefulness of cherished weapon systems or to question service perquisites. How much "public irresponsibility" persists in 1961?

Murray Green
Silver Spring, Md.

WW I Flyers Get-Together

Gentlemen: On December 2, 1960, the Air Force Museum, in collaboration with Capt. Eddie Rickenbacker and Mr. Douglas Campbell, held an informal get-together of WW I flyers in New York City to review some historic film of WW I aviation in France. All those attending enjoyed themselves so tremendously in meeting together for the first time in forty-two years that they decided they should have an annual reunion, to be held at the Air Force Museum, Wright-Patterson AFB, Dayton, Ohio.

The first reunion is to be held on June 24-27, 1961. To give WW I flyers the recognition we believe is properly due them, we have selected June 25, 1961, as Air Force Museum Day, the theme of which is to be devoted to WW I aviation. Airmen who flew overseas in WW I are to be the guests of honor during ceremonies to be held for the public on Sunday.

Highlight of Sunday's activities will be an air show featuring WW I aircraft such as the Spad 13, Nieuport 28, Sopwith Camel, and Fokker D-7 along with many other famous aircraft of the period.

Those interested in attending may obtain detailed information by writing:

World War I Reunion
Air Force Museum
Wright-Patterson AFB, Ohio

B-24 Airplane Driver

Gentlemen: Our April issue of AIR FORCE Magazine, page 50, arbitrarily elevates the B-17 to a highly contestable status: ". . . the deadliest weapon system of its time."

What of our famed B-24 Liberator which not only could, but did fly faster, fly farther, and carry a heavier payload than the B-17?

We old B-24 people "All of us AFA members," are quite tired of fictitious claims made for that "other plane." Fly the planes—read the specs. We had 'em beat!

R. E. Frankenberry
Bridgeville, Pa.

Biog of an Outstanding General

Gentlemen: I am writing a biography of Gen. John J. Pershing (1860-1948), commander of the AEF in the first World War. I would appreciate hearing from anyone who has letters, anecdotes, reminiscences, or other information about General Pershing.

Donald Smythe, S.J.
Georgetown University
Washington 7, D. C.

Good News for the Sixty-fivers

Gentlemen: . . . I note with great pleasure that the AFA is providing insurance for officers up until age sixty-five regardless of active-duty status. This is a real good thing, and I suspect that a great many of us will take advantage of it. It also could be that as the number of members grow, conceivably the amount of benefits at age sixty-five might become even greater.

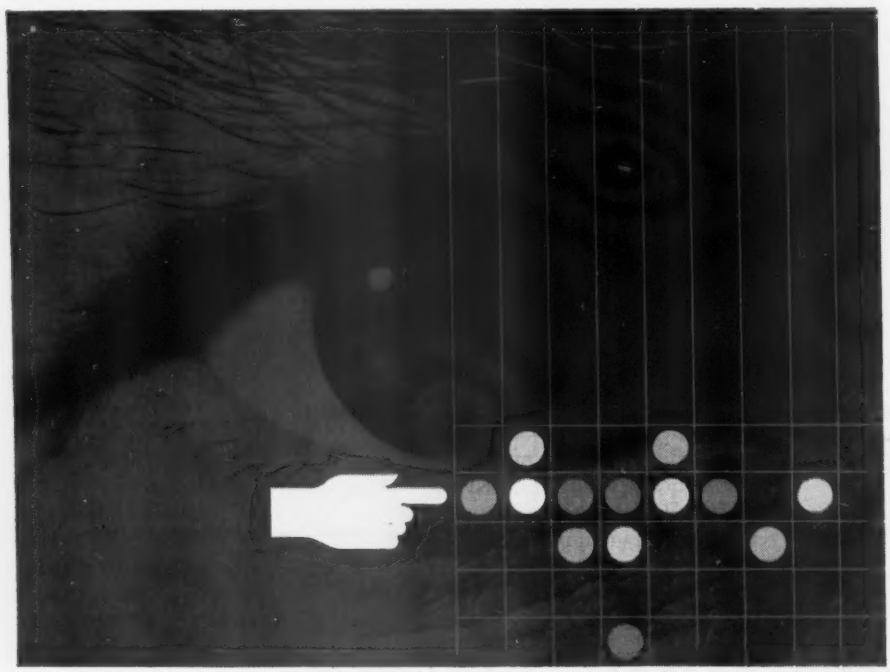
Your present policy is an excellent one, particularly for those of us who are getting around to retirement time.

Col. John E. Condron
Wright-Patterson AFB, Ohio

Additions to AF Arsenal

Gentlemen: Regarding the article about the T-38 Talon by Ed Mack Miller in the March issue of AIR FORCE/SPACE DIGEST, I think he did a fine job. I would like to see more articles of this type about the new and interesting aircraft being added to the Air Force's arsenal of weapons. Keep up the good work. I enjoy your magazine very much and think that it gets better every month.

George LaSalle
Phoenix, Ariz.



THINK, ACT! How will crews of aerospace vehicles perform under long periods of stress and confinement? Lockheed/Georgia finds accurate answers in the crew mockup section of its Behavioral Research Lab – just one of the many capabilities of its highly qualified Human Factors Research Group. LOCKHEED/GEORGIA

Marietta, Georgia

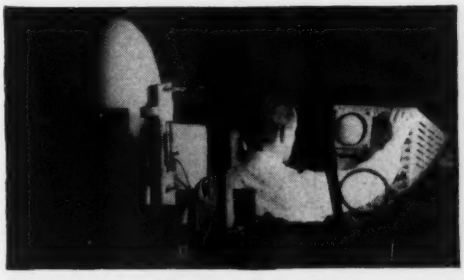
UNIT REUNIONS

468th Bomb Group—July 28-30, 1961
Fifth Reunion of the Group will be held at the Hilton Hotel, Pittsburgh, Pa.
Contact: Mr. Loren E. Reitz (Host)
221 Fourth Street
Pittsburgh 22, Pa.
or
Mr. John Phelan (Secretary-East)
1492 Highland Ave.
Needham, Mass.

11th Bomb Group (H)—Aug. 19-20, 1961
Members of the outfit from 1940-45 during World War II in the Pacific Theater. Reunion will be held in Toledo, Ohio.
Contact: Robert E. May
12000 Eckel Junction Rd.
Perrysburg, Ohio

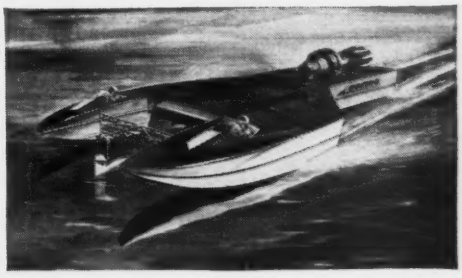
AUTOMATIC SKY FIGHTER. Supersonic Boeing BOMARC is U.S. Air Force's push-button defense weapon against airborne missiles and attacking bombers. New "B" models have scored test intercepts up to 446 miles from base at altitudes of more than 100,000 feet, establishing new surface-to-air defense missile records for range and altitude. BOMARC A models are now operational at five U.S. Air Defense Command bases. B models will be installed at six bases in the United States and two in Canada.

Capability has many faces at Boeing



WIND SONDE, developed by Boeing subsidiary, Allied Research Associates, will measure wind direction and velocity at wide range of altitudes, telemetering data back for instant use at missile launch ranges, other weather stations.

SPACEMAN'S BLAST-OFF. Boeing Space Medicine researcher prepares for simulated blast-off, wearing belt of Boeing-developed miniature electronic instruments which measure reactions to stresses imposed by take-off of space vehicles.



JET-PROPELLED TEST BOAT, now being built for Boeing, will be used to test experimental surface and subsurface marine vehicle designs at speeds up to 100 knots. Test models will be suspended between two forward hulls. Test boat will supplement Boeing tow-tank research in advancing knowledge in area of hydrodynamics.

BOEING

What's New With ★ RED AIRPOWER

Here's a summary of the latest available information on Soviet air intelligence. Because of the nature of this material, we are not able to disclose our sources, nor document the information beyond assurance that the sources are trustworthy.

Large numbers of technical papers published under the Soviet combustion research program show that the liquid oxygen-kerosene and liquid oxygen-liquid hydrogen propellant combinations have received great attention. Other studies which have received significant effort include: propellant droplet evaporation and energy release, ozone additives for high-altitude flight, burner design, thrust augmentation and afterburner design, detonation waves, and the development of a theory to explain and control "cool" flames which will increase effective engine air temperature and thrust without raising the temperature of the engine parts.

In several areas the Soviets have not published any research information, indicating either a lack of interest or a high security classification. For instance, almost no Russian research has been reported in solid propellants although they are known to use four solid sounding rockets plus several solid-fuel bombardment rockets in the Red Army. The open literature also does not contain Soviet work with fluorine, hydrazine, or boron-base-high-energy fuels.

Soviet combustion research is generally regarded as excellent by the US experts who have had an opportunity to review the available material. The Russians have maintained a good balance between the theoretical and the experimental. Individual scientists working on the program apparently have been well briefed on practical combustion problems facing rocket and air-breathing engine designers. The scientists have been particularly effective in relating their work to engineering development.

Considerable economy of effort is practiced by the Russians. They are known to have saved themselves work by using large amounts of basic experimental data published in the West without any sort of checking.

Some of the better Russian work in this field is held back for five years or more after completion. Even with this handicap it has been possible to determine that combustion research is receiving a major effort in the Soviet Union.

° ° °

An Aeroflot, Tupolev TU-104 jet transport modified to carry a large group of astronomical instruments was used to extend the observation time of the total solar eclipse that occurred over southern Russia during February. Nor-

SPACE TRUCK

Many of America's major space programs now use the same production-line satellite —the Lockheed-built Agena B—which puts all kinds of payloads on orbit with maximum certainty, accuracy, and economy.

LOCKHEED

Missiles & Space Division, Sunnyvale, California

mal observation time at a ground point during this eclipse was about 162 seconds. It was hoped that this could be extended to 242 seconds by chasing the moon's shadow in the TU-104. The operation was partially successful as the scientists aboard the aircraft were able to make good measurements for 226 seconds.

If Russian newspaper accounts are correct the TU-104 covered 34.1 miles during this all-out 226-second dash at 32,800 feet. This means that the aircraft was flying at about Mach 0.85, assuming a winter-day temperature a little colder than average.

Aircraft also made it possible to observe the eclipse from the ground. On the morning of the event a heavy overcast covered most of the Ukraine. Aeroflot airplanes sprayed enough chemicals over the instrumentation positions to disperse some of the clouds and form windows through which optical observations were made. Even though a haze remained in these windows, a number of the Russian astronomers reported satisfactory measurements.

* * *

Another world record for aircraft has been claimed by the Soviets. It has been reported in Moscow that an E-66 deltawing airplane reached an altitude of 112,204 feet during a zoom climb. The current world record of 103,389 feet is held by Capt. Joe Jordan, USAF, in an F-104C.

The E-66 apparently is one of a series of deltawing fighters designed by Pavel Sukhoi. The first of this series flew over Moscow in the mid-1950s.

Undoubtedly the early versions which appeared in air reviews have been improved to reach the speeds and altitudes the Soviets claimed for them. The E-66 and some mysterious airplanes with "Z" and "T" designations have been vying with the latest US Air Force and Navy fighters for world performance records. In this campaign the Soviets have satisfied every requirement for course monitoring and data-gathering that the keeper of the records, the Fédération Aéronautique Internationale, requires. The configuration of these aircraft can be kept secret because the FAI rules do not require foreign observers to be on the scene during a record attempt in any country. Further, it is not required that a picture or close description of the aircraft be supplied.

Suggestions that the requirements be stiffened somewhat to include a picture of the record-setting airplane have been rejected by the general membership of the FAI because of the opposition of Soviet bloc nations.

The Russians hold twenty-two out of forty-two recognized world records for turbojet-powered aircraft weighing more than 10,000 pounds. Of these three are held by the well known TU-104E. The remainder of the records are split among three aircraft which are known only from the following descriptions: RV monoplane with two 37V engines, 103M midwing monoplane with four D-15 engines, and the 201M midwing monoplane with four D-15 engines. None of these aircraft and engine designations have ever appeared outside of the record claims.

* * *

Soviets report that they have operated reactors with fuel elements made of glass fibers containing uranium oxide. It is also considered possible to use oxides of plutonium and thorium as nuclear fuel in tiny strings of glass.

The Russians state that these fibers can be used up to 1,800 F. But their technical literature contains many discussions of work with glass ceramic materials which will hold their strength and chemical stability to temperatures several hundred degrees higher. Much of the Russian work with high-temperature glass is aimed at improving its properties for drawing into continuous fibers.—END

THEY ALL HAVE GENERAL P

① **B-52 STRATEGIC BOMBER**—Inertial system for heading and vertical reference and for accurate release of Hound Dog and Skybolt missiles; Doppler navigation system—all by General Precision.

② **F-104J SUPERSONIC FIGHTER**—All-attitude reference system by General Precision.

③ **F-106A SUPERSONIC FIGHTER**—Flight simulator and stable coordinate reference system by General Precision.

④ **B-58 SUPERSONIC BOMBER**—Flight simulator by General Precision.

⑤ **F8U-2N SUPERSONIC DAY FIGHTER**—Flight simulator by General Precision.

⑥ **A3J-1 NAVY ATTACK BOMBER**—Weapons system simulator—including flight, radar and ground mapping simulation - by General Precision.

⑦ **KC-135 JET TANKER**—Doppler system and directional gyro compass system by General Precision.

⑧ **F-100 SUPERSONIC FIGHTER**—Doppler system—navigation computer and directional gyro compass system by General Precision.

⑨ **RF-101 SUPERSONIC RECONNAISSANCE FIGHTER**—Doppler system and roll-stabilized directional gyro compass system by General Precision.

⑩ **RB-47 RECONNAISSANCE BOMBER**—Doppler system, directional compass system and true-heading computer system-including flight simulator - by General Precision.

⑪ **B-70 HYPERSONIC STRATEGIC BOMBER**—Ultra-high accuracy General Precision Doppler equipment for the bomb-nav system.

⑫ **RC-121D EARLY WARNING RADAR AIRCRAFT**—Doppler sensor, Doppler-inertial combiner/position keeper, central gyro reference system and directional compass system by General Precision.

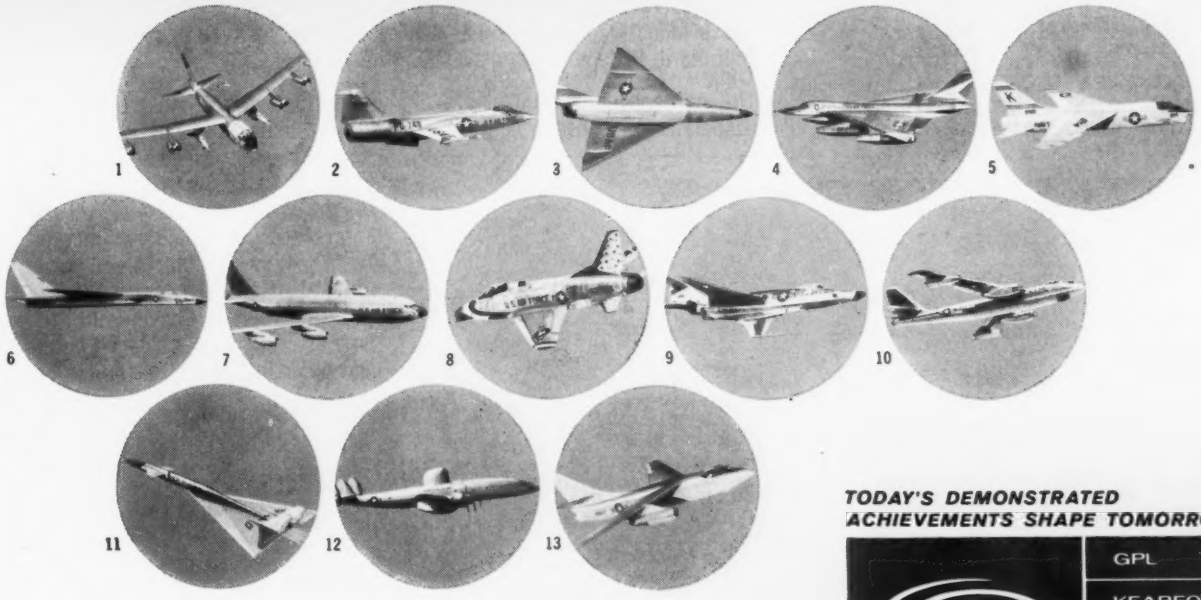
⑬ **A3D-2 NAVY ATTACK BOMBER**—Bombing-Navigation computer by General Precision.

L PRECISION IN COMMON

Manned aircraft of the aerospace age share a common reliance on General Precision's electronic and electromechanical systems in the performance of complex missions. Nearly all advanced aircraft flown by our armed forces incorporate General Precision navigation and heading reference equipment. In addition, the fliers that man the aircraft have been largely trained on General Precision flight simulators.

The four divisions of General Precision, Inc., are consolidated for the systems management of major new weapons and space projects. As a result, a manned-aircraft systems program can draw upon more than 16,000 General Precision employees (including 4,500 scientists, engineers and technicians) and well over 2½ million square feet of combined plant space.

This combination of talents and facilities, backed by the corporate financial resources of General Precision, Inc., makes it possible to develop, produce and manage any advanced system for manned aircraft.



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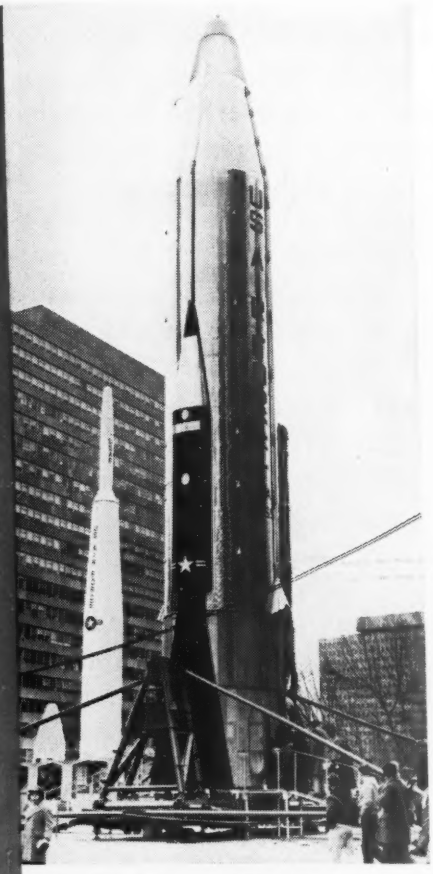
And Aerospace Panorama



Philadelphians—who have viewed America's missile might—will get an even longer look during AFA meet.

ATTENDANCE • 1960 CONVENTION • SAN FRANCISCO

Convention Registration	3,924
Panorama Attendance	61,962
Program Participants	115
News Representatives	405
United States Air Force	
Secretariat	4
General Officers	71
Colonels	211
Other Officers	201
Foreign Government Representatives	9
US Government Representatives (Other Than USAF)	37
Education	121
Industrial Companies	408
Industrial Representatives	1,796
Presidents and Board Chairmen	131
Vice Presidents	250
Executive Assistants and Consultants	94
Managers	669
Engineering Personnel	132
Purchasing, Sales, and Advertising	229
Other	291
Exhibiting Companies	195

ATTENDANCE • 1961 CONVENTION • PHILADELPHIA

Attendance at the 1961 Fifteenth Anniversary Convention and Aerospace Panorama in Philadelphia (based on advance reservations) will break all previous records. Philadelphia itself is located in a high-density aerospace industry area. It is easy to reach from New York, New England, Baltimore, Pittsburgh, and Washington, D. C.

The Aerospace Panorama is a unique platform for prime contractors, associate contractors, and subcontractors to display and personalize their capabilities, services, and products to the management men of the multibillion dollar US Air Force-Aerospace industry market. The Aerospace Panorama is an integral part of Air Force Association's National Convention, the largest annual aerospace power and defense meeting in the nation.

Panoramic view of the New Philadelphia. This is Philadelphia's Penn Center area from City Hall to 30th Street Station, symbolic of great modernization now under way.

15th Anniversary Convention

Philadelphia • September 20-24, 1961

PROGRAM

Tuesday, September 19

9:00 AM	Worldwide USAF Info Conf

Wednesday, September 20

9:00 AM	Worldwide USAF Info Conf
2:00 PM	AFA Directors Meeting
7:30 PM	AFA Leaders Meeting

Thursday, September 21

9:00 AM	Reserve Forces Seminar
9:00 AM	Arnold Air Society Meeting
10:00 AM	Aerospace Briefing
12:30 PM	15th Anniversary Luncheon
3:00 PM	Aerospace Briefing
3:00 PM	1st AFA Business Session
7:00 PM	Panorama Preview Reception

Friday, September 22

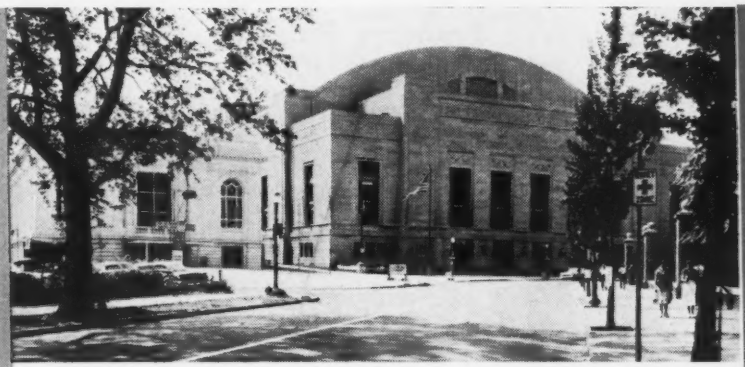
9:00 AM	2d AFA Business Session
9:00 AM	Aerospace Education Seminar
9:00 AM	Aerospace Briefing
11:00 AM	Aerospace Briefing
12:00 N	Aerospace Education Luncheon
12:00 N	Industry Buffet Luncheon
12:00 N	Panorama Open to Registrants
2:30 PM	Annual Symposium
7:45 PM	Awards Banquet

Saturday, September 23

8:00 AM	AFA Honors Breakfast
11:00 AM	Aerospace Briefing
12:00 N	Outstanding Airmen Luncheon
12:00 N	Panorama Open to Public
2:30 PM	3d AFA Business Session
2:30 PM	Aerospace Education Seminar
9:30 PM	Air Force Reunion Party

Sunday, September 24

12:00 N	Panorama Open to Public



Philadelphia's Convention Hall, where Convention will meet.

Everyone is requested to register IN ADVANCE. Credentials will be required to attend meetings and the Panorama during "closed" periods.

Complete, Attach Payment, and Mail to AFA
1901 Pennsylvania Ave. N.W., Washington 6, D. C.

ADVANCE REGISTRATION FORM FOR AFA'S 1961 CONVENTION

NAME ..... RANK, IF MILITARY .....

TITLE .....

AFFILIATION .....

ADDRESS .....

CITY & STATE .....

Check ONE of the categories with which you wish to be identified:

☐ GOVERNMENT ☐ INDUSTRY ☐ AIR FORCE ASSOCIATION
☐ EDUCATION ☐ MILITARY ☐ PRESS-RADIO-TV

Check the type of registration desired, attach payment, and mail to:

AFA, 1901 PENNSYLVANIA AVE., N.W.
WASHINGTON 6, D. C.

☐ **INDUSTRY REGISTRATION** **$35.00**
(Includes tickets and credentials to all Convention events including Industry Luncheon and Briefings)

☐ **REGULAR REGISTRATION** **$25.00**
(Includes tickets and credentials to all Convention events except Industry Luncheon)

☐ **BASIC REGISTRATION** **$10.00**
(Includes credentials, meetings, Panorama Reception, but not tickets to any of the other Convention events)

6-61

AIRPOWER in the news

Claude Witze
SENIOR EDITOR, AIR FORCE MAGAZINE

Strategy Is a Program Package

WASHINGTON, D.C.

If there is a prize given at the end of 1961 for the Most Neglected News of the Year, the award in the Pentagon will go to Comptroller Charles J. Hitch's new approach to the budget. His concept, which was discussed in this space in February ("Cost Is Related to Strategy"), is the economist's manifestation of the New Frontier and its impact on military decisions. With the exception of a single service journal, both the daily and trade press has practically ignored the Hitch edict to the armed forces, which was formally promulgated in mid-April for application to fiscal 1963 budget procedures.

The Defense Department Comptroller says that from here on the emphasis will be on a "Program Package" approach to military requirements. The fundamental objective "is to integrate the planning and programing and the financial management functions in order to provide better tools for decision-making by the Secretary of Defense and his military advisers; and to create a planning and programing/financial management system that is keyed to continuous program decision-making and not just geared to the annual budget cycle." In order to provide this type of integration there is a new Programing Office in the Comptroller's office.

There is no doubt that military budget toilers will welcome the divorce from an annual reappraisal of each project, usually painful. Maj. Gen. Robert J. Friedman, USAF Budget Director, has made a strong plea for this kind of an approach in his appearances on Capitol Hill. The crying need for longer-range planning has become more and more evident as weapon systems became more complex and more expensive, and the fight was intensified to keep them from obsolescence before they were operative.

What is more important are the steps outlined by Mr. Hitch that will lead to what he calls the "programing phase." This is where "attention will be focused on choice from among alternative programs to achieve our national security objectives." This is assumed to mean that the decision to go ahead or stop work on a weapon system will be made on the basis of cost and effectiveness, plus:

- Basic policy guidance will be provided by a new Basic National Security Policy paper. It is in preparation and was under review by the Secretary of Defense and his advisers last month. At this writing there has been almost no public recognition of the fact that this document is on the way and that it will have an important bearing on our national survival.
- As many programs as possible, particularly the ones that are most expensive, must be classified according to their mission or the mission they will help perform. This is what is meant by the "program package and program element" approach.

"By a program element," Mr. Hitch says, "we mean an integrated activity, a combination of men, equipment, and installations, whose effectiveness can be related to our national security policy objectives; as examples we have in mind such forces as B-52 wings, infantry battalions, and combatant ships, taken together with all the equipment, men, installations, supplies, and support required to make them effective military forces. . . . The Central War Defensive Forces would be an example of such a package. The unifying principle of such packages is a common mission or set of purposes."

Charles J. Hitch, Comptroller, Department of Defense.

Mr. Hitch said that the job of identifying these packages is under way and that a program package team is being formed. It will have members from his office of programing, each military department, the Joint Chiefs of Staff, and the office of the Assistant Secretary for International Security Affairs. On the surface, this reads like a further move for unification within the structure with the added virtue that the services have been asked to identify their program packages and elements "not only for FY '63, but for five to ten years into the future."

- There will be "guidance," Mr. Hitch says, for the military on the studies and analyses that are necessary for program review. This is where cost and capabilities will be weighed, with a clear reference to the theme of his book, *The Economics of Defense in the Nuclear Age*, which says "the job of economizing . . . cannot be distinguished from the whole task of making military decisions." Mr. Hitch is known to believe that the way to save is in the choice of strategies to achieve objectives.

The kind of questions on which guidance will be offered as the Army, Navy, and Air Force work over their budgets to a new formula involve the alternatives when capital investments are made—shall we use an old ship, modernize it, replace it, or dispense with it? How busy should our forces be, and how should they be deployed in view of the costs involved and what they contribute to security? How good is the management and organization?

Mr. Hitch has promised there will be a "Big Board" in his Office of Programing where package decisions will be listed and maintained on a day-to-day basis. He has

(Continued on page 21)

Capability in Power and Mobility for defense

Problem: Vehicle clutch-fade, premature failure from high temperatures, heavy loads, and high horsepowers. *Needed:* A clutch built to withstand maximum load and temperatures. *Produced:* From Caterpillar research of surfaces, lubricants, metals, and configuration, the oil-type clutch. With plates bathed in oil in a sealed compartment, it has a service life up to four times greater than standard dry clutches. This development typifies Caterpillar capabilities in producing sound and practical solutions for mobility needs. As a leading producer of heavy equipment, Caterpillar has outstanding resources in research engineering and manufacturing. This experience and talent are available to you to meet your vehicle, transmission, or power requirements. For full details of capabilities, write for Bulletin No. 40-20265.

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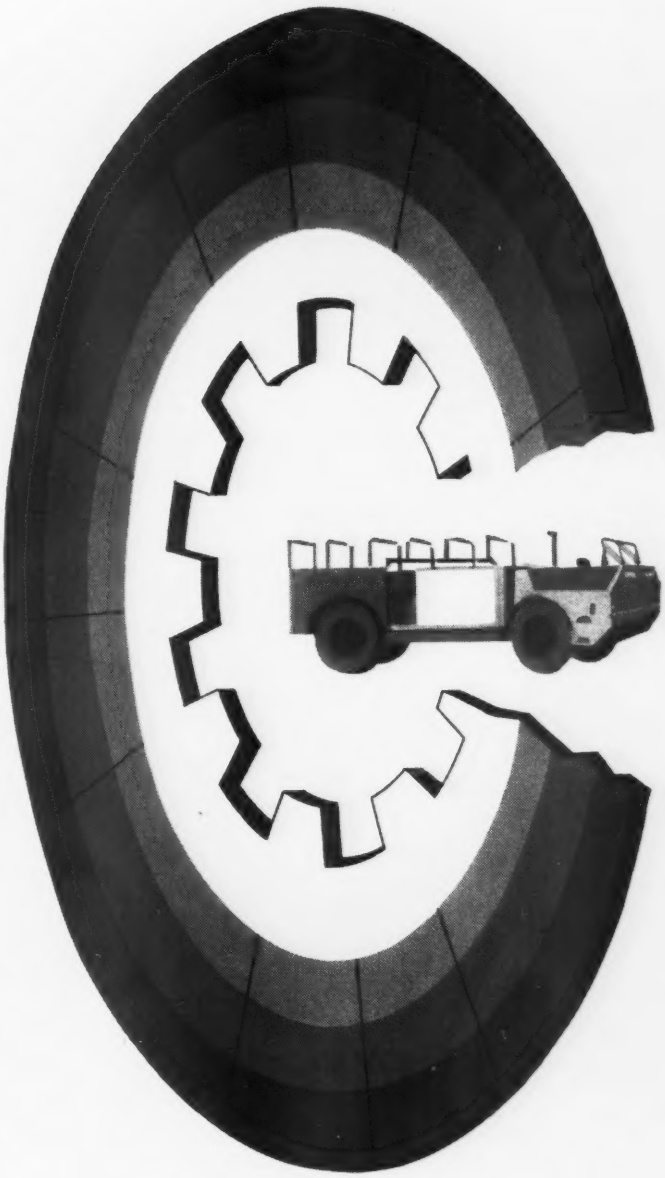

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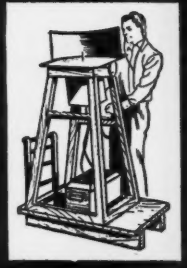
WASHINGTON, D. C. PEORIA, ILLINOIS

RESEARCH-DEVELOPMENT-MANUFACTURING FOR DEFENSE

IN COMMUNICATIONS... ITT MAKES THE FUTURE HAPPEN SOONER

In **1941**, Andre G. Clavier, an **ITT** scientist, detected the phenomenon now known as tropo-scatter.



SEPTEMBER 1957: ITT DELIVERS THE WORLD'S FIRST COMMERCIAL BROADBAND "O/H" TROPO-SCATTER LINK

This ITT triumph over line-of-sight limitations climaxed many years of experimental transmissions by ITT, conducted to perfect the over-the-horizon (O/H) tropospheric scatter technique. This link spans the 180 miles between Florida and Cuba, transmitting 120 telephone voice channels simultaneously with high-quality television signals.

Today, ITT-developed O/H tropo-scatter networks crisscross Europe, North Africa and the Caribbean, transmitting critical NATO and Air Force commands, TV broadcasts and telephone voice signals with an operating reliability ranging from 99.900 to 99.995%.

Filling the big order for complete O/H tropo-scatter networks anywhere in the world is but one example of the vast systems capabilities of ITT Federal Laboratories.

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found from the fiscal 1962 figures that 145 weapons and items of equipment account for seventy-five percent of procurement appropriations and forty-five percent of the R&D and construction appropriations. This is what has him convinced that the program package system can be managed. Most of the money will be in hand, with its destination plotted on the Big Board.

In an editorial comment, the *Army, Navy, Air Force Journal* finds good in the fact that budgets will be formulated, at least in the early stages, on the basis of military requirements rather than a dollar limitation. The program, says the *Journal,* "is in striking and refreshing contrast to the previous process of telling the defense experts to formulate the best defenses they can devise within a fixed dollar limitation." But, the editorial warns, there is a need for Secretary McNamara to "give due heed to the recommendations of the professional, war-tested career military leadership as well as to the civilian advisers and secretariat."

Here is a reference to the rub: *Who* is to determine strategies and security policy and formulate military concepts? There is increasing and undeniable evidence in the Pentagon, as the First Hundred Days of the New Frontier are torn off the calendar, that the Grand Strategy, as it is called in *Fortune* magazine, is going to be changed. And there is equal and convincing evidence that the role normally played by the military in the formation of doctrine, strategy, and concepts is being reduced and may be eliminated. There is a cross-department group in the New Frontier, with membership in Defense, State, and the White House staff, that has been defined by *Fortune* magazine as the "Technipols." Some of them, at least, would like to guide our military policy, fix our strategy, and monopolize all discussion of military concept. Mr. Hitch, no doubt, is clean of such ambition, but his "program package" approach to the budget can lend itself as a tool in carrying out the changes in force structure that the Technipols have endorsed. There is nothing basically evil about this approach from the standpoint of managing the military establishment, and we have in the past applauded some of the earlier New Frontier decisions in this direction.

For several years the Air Force Association has endorsed the principle of a single service and a single war plan with realistic evaluation of weapon systems on the basis of what we need to fill military requirements. But there is a difference, and a profound one, between the idea of promoting a unified military effort and the elimination of military people from the decision-making process. This is particularly true in the areas of strategy, concepts, and policy. There are distressing signs that this is taking place. *Fortune* says that the Technipols are no admirers of the military and that they "know all the tricks for putting important matters in train past a wavering, stubborn, or indifferent executive."

There is no authoritative report on the collective approach to national defense by the Technipols but a fair suggestion can be taken from a book called *The Nation's Safety and Arms Control,* by Arthur T. Hadley (Viking, $3.00). This volume was written by a reporter who was invited to sit in on the 1960 Summer Study Conference on Arms Control at the Massachusetts Institute of Technology. It does not purport to be a report on the proceedings of the Summer Study, but is a layman's account of what the experts see as the problems and possibilities of arms control. It is good that the book seems to recognize the possibilities of arms control that can be made real as a result of the advances ahead in space technology. It recognizes some of our deliberate weaknesses, such as the lack of a sound civil-defense program. But it also holds the military up to scorn. It discounts, for example, the 1960 statement of Gen. Nathan F. Twining that "forces that cannot win cannot deter." It makes out a case for the argument that this country has erred in arming itself with a nuclear arsenal because it has failed to demonstrate that it is prepared to fight a nuclear war. It presents the argument for the Polaris and Minuteman systems and against the manned bomber. It is, in short, a text explanation of the Kennedy defense budget for fiscal 1962, as outlined in last month's AIR FORCE/SPACE DIGEST.

In any discussion of the situation on strategy and military doctrine, the determination of the Kennedy Administration to do something about arms control is an important factor. This is because the forces working hardest for the cause of arms control—and it is a good cause—have not enlisted the people who know the most about arms. Far from putting arms experts on the team, they are inclined to look upon them as natural enemies of the cause. The list of participants and visitors to the Summer Study on Arms Control at MIT does not disclose a single military title.

The expression of this approach in the Pentagon today is the obvious bypassing of the Joint Chiefs of Staff in the formulation of military concepts, strategy, and general security policy. Men in uniform, it is becoming clear, will be expected to operate the unified commands and implement war plans after the basic decisions have been made by their intellectual peers. These basic decisions, moreover, will not be confined to doctrines and concepts and strategy, but will be carried through Mr. Hitch's "program

(Continued on following page)

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I've invented A WEAPON THAT WILL REVOLUTIONIZE the LIFE OF MAN
4-18
MY NEW WEAPON IS SO DEADLY THAT IT WILL MAKE WAR UNTHINKABLE
MAN MUST FINALLY LIVE IN PEACE
Yes indeed I HAVE TRULY INVENTED the ULTIMATE WEAPON
I CALL IT the BOW AND ARROW
MAL

Reprinted with permission of the George Matthew Adams Service, Inc.

Not long after the first Kennedy Administration defense budget figures went to Capitol Hill, "Nibbles," a comics page commentary, offered this thought about the ultimate weapon. The revised budget increased the nation's ICBM arsenal.

packages" to determine force structures, weapon systems, resources, and the priorities that will be given to military needs. This means that the Chiefs of the Army, Navy, and Air Force in the long run will be the managers of what resources are approved and given to them.

Elimination of the military mind from the process of determining strategy and concept has been made evident in the sharp curb on speech-making and writing by military men. There have been sparks here and there in the press—the Chief of Naval Operations had a speech shot down with a blue pencil, and an Air Force professional publication has found holes in its pages at printing time. This situation can be expected to continue and get worse, and the service secretaries themselves will feel the curb.

Probably the most evident manifestation of new Pentagon policy on policy is in the area of public information. The press corps is increasingly irritated as Pentagon officials who once were news sources are becoming hard to find. More important, the kind of military or civilian expert who, as recently as 1960, would sit down for a casual and informative chat with a reporter now is under orders to avoid this situation.

Report on Aerospace

Here in the early spring it is time for congressional investigations to compete for the headlines. This year they have been getting competition from Commander Shepard, D-Day in Cuba, the First Hundred Days of the New Frontier, and some of the unsavory items that have embarrassed the Kennedy Administration. Up on Capitol Hill there is the usual scramble for subjects that are vulnerable for probing, with committees racing each other to get out the calls for witnesses. So far Senator McClellan and Senator Kefauver, who have been quizzing people about the scandals at Cape Canaveral and General Electric, seem to have latched onto the best subjects. The parallel between the amorality of union and corporate minorities has been evident to everyone.

One of the more refreshing documents to come out of Congress in the midst of this scene is a fifty-four-page report from the Military Operations Subcommittee of the House Committee on Government Operations. It is a recap of a study made last year on the formation of Aerospace Corporation, the new nonprofit organization set up in California to manage USAF's missile and space programs. The committee chairman, Rep. Chet Holifield (D.-Calif.), told the House that the new report "takes the realistic position that the Air Force does not have the in-house technical resources and manpower to perform the functions assigned to Aerospace. Neither is it likely that the Air Force will acquire such resources in the foreseeable future."

Mr. Holifield also pointed out that some of the Air Force management problems "have wide application throughout the defense establishment and other agencies of the government." The Chairman claimed credit for a report that is realistic, critical, but not carping. He said, "We realize that we are dealing with issues of the highest national importance which effect the very survival of this nation."

The timeliness of the Holifield report on Aerospace derives from the fact that a number of other committees have the new company on their agenda or are considering investigations. They are interested in Aerospace's employee procurement program, or its salary levels, or the USAF policy of buying help from outside brains, or possibly some aspect of the growing utilization of nonprofit organizations with government contracts.

Much of the report is given over to a review of the knotty situation created by USAF's earlier utilization of Space Technology Laboratories, a subsidiary of Thompson Ramo Wooldridge Inc., as technical manager for the ballistic missile programs. The Holifield Committee recognizes all the weaknesses of the STL/TRW setup and how the profit motive turned out to be incompatible with that corporation's responsibility for managing the development of weapon systems.

Turning the same light on Aerospace, now about a year old, it finds that STL personnel—270 of the old scientific and technical staff—have moved to the new company with average pay increases of two and a half percent. For persons taken from industry and universities the figure climbed to eight percent. The report that the highest salary for a scientist is near $40,000 a year is denied. In April of this year only five on the technical staff had been hired from government payrolls. Aerospace is sensitive, the report says, to the charge that it is a device to get around federal salary limitations:

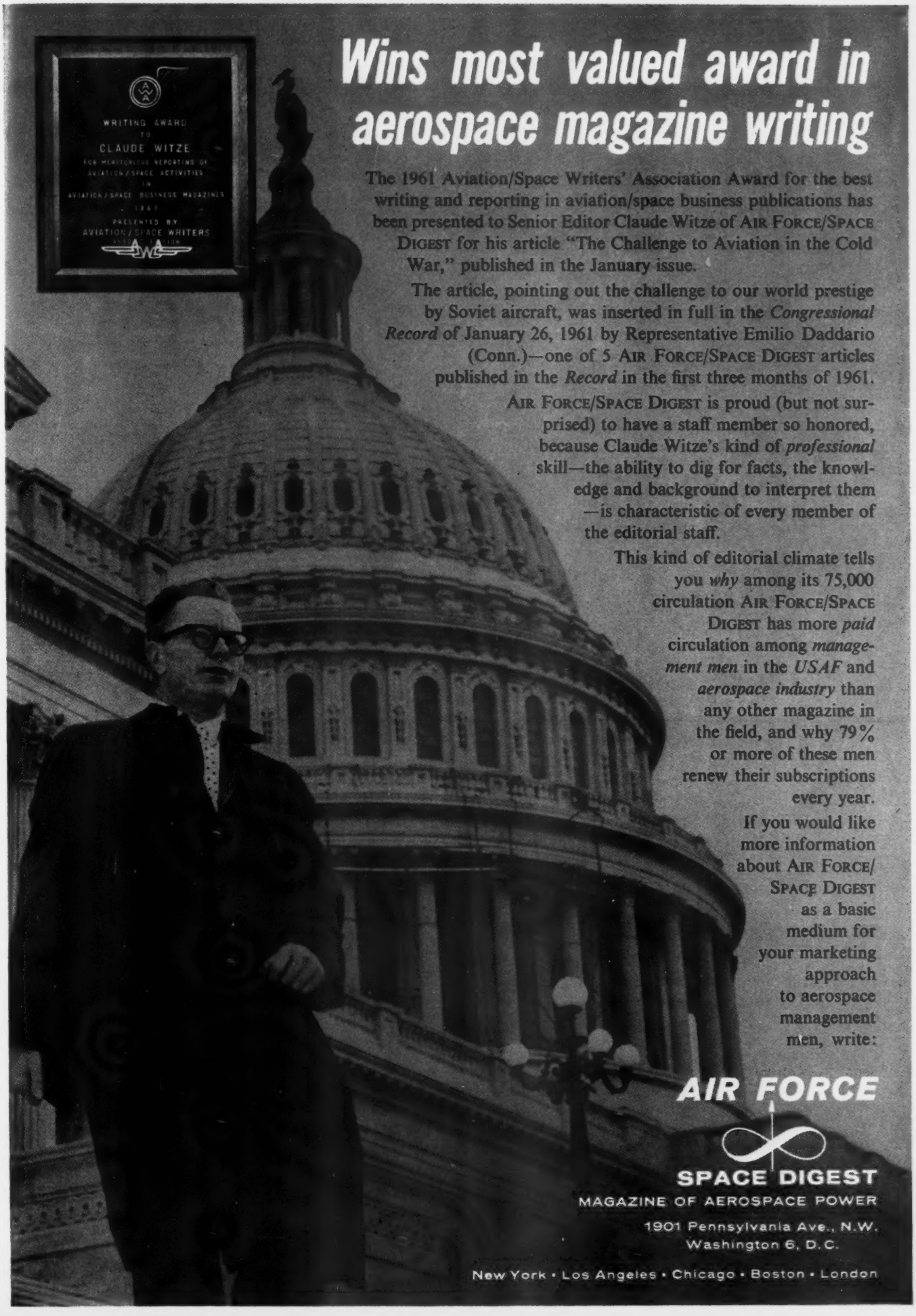
"Aerospace is convinced that government employment does not offer the most suitable environment for scientific and engineering personnel to work effectively, granted that there are many persons of outstanding talents in government service. The drag of procedural detail, the time-consuming demands of routine chores, the inability of some lay or military supervisors to understand or fully appreciate the scientific mood and method, and the replacement of management prerogatives by statutory pay grades and other standardized formulas, are considered unfavorable attributes of the government environment for scientific work."

The report admits there is merit in some criticism from those who look at Aerospace from the outside. There is cited the industry spokesman who wants to know why his company can't do the job for USAF. There are others, in Congress and the Comptroller General's office, who feel the work should be done in-house by USAF personnel. But, the report argues, the perspectives of critics on both sides are limited:

"No single weapon system contractor, however large his contract commitments and diversified his industrial resources, can have the breadth of vision, the alertness to national defense needs, the degree of access to information, the choice of alternative systems, the decision-making responsibilities, and the dedication to the public interest expected and required of a government agency. And if the government agency—in this case the Air Force—does not have the requisite resources and capabilities to fulfill its requirements and meet its obligations, it must get them as best it can.

"Whether the government agency should hire and train its own personnel and build its own laboratory, experimental, and production facilities, or whether it should obtain the necessary manpower, services, goods, and facilities under contract, are questions which admit of no simple and pat answers and are cause for continuing controversy."

There is small hope that these frank words about the sensitive areas around Aerospace will temper all of the attacks under contemplation in Washington. But if they are studied in the light of Aerospace's growing responsibility since creation of the new USAF Systems Command, they are weighty words as well. The entire military space program now must travel this road, be it bumpy or smooth.—END



Wins most valued award in aerospace magazine writing

The 1961 Aviation/Space Writers' Association Award for the best writing and reporting in aviation/space business publications has been presented to Senior Editor Claude Witze of AIR FORCE/SPACE DIGEST for his article "The Challenge to Aviation in the Cold War," published in the January issue.

The article, pointing out the challenge to our world prestige by Soviet aircraft, was inserted in full in the *Congressional Record* of January 26, 1961 by Representative Emilio Daddario (Conn.)—one of 5 AIR FORCE/SPACE DIGEST articles published in the *Record* in the first three months of 1961.

AIR FORCE/SPACE DIGEST is proud (but not surprised) to have a staff member so honored, because Claude Witze's kind of *professional* skill—the ability to dig for facts, the knowledge and background to interpret them—is characteristic of every member of the editorial staff.

This kind of editorial climate tells you *why* among its 75,000 circulation AIR FORCE/SPACE DIGEST has more *paid* circulation among *management men* in the *USAF* and *aerospace industry* than any other magazine in the field, and why 79% or more of these men renew their subscriptions every year.

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The 11th Annual
AIR FORCE ALMANAC

SEPTEMBER 1961

. . . the special issue of AIR FORCE/SPACE DIGEST which pinpoints the nation's largest air and space force . . . *the USAF*. Here is the latest information on Air Force projects, weapons, bases, and major commands, complete in one volume which is used year 'round as desk-top reference.

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10,000 Bonus Circulation in addition to regular 75,000 guaranteed paid (with no increase in rates). This bonus distribution will go to key personnel in the USAF, aerospace industry, and government, including a 3,000 circulation to Registrants at Air Force Association's Annual Convention, Philadelphia, September 20-24. If your company is planning to exhibit at the Panorama, you can merchandise your display or hospitality suite through your advertisement in the ALMANAC reaching regular subscribers well before the Convention starts . . . as well as in the at-Convention distribution.

for the reader . . .

- **USAF in operation: capsule report on last year's activities; comprehensive study of the future projects and programs.**
- **Review of the major commands, including the newly organized Air Force Systems Command and its divisions.**
- **A guide to all USAF bases.**
- **A photo gallery of USAF aircraft and missiles.**

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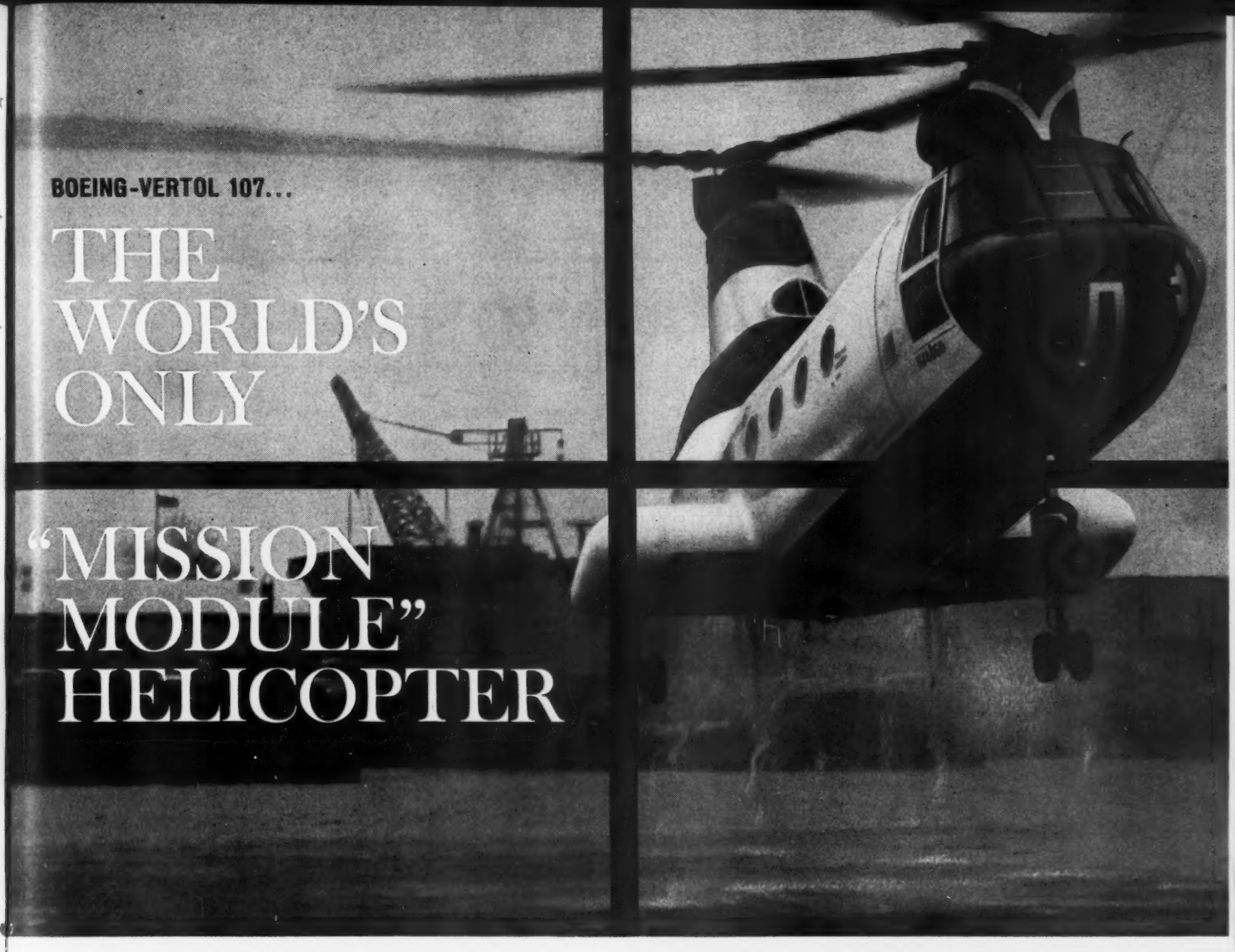


BOEING-VERTOL 107...

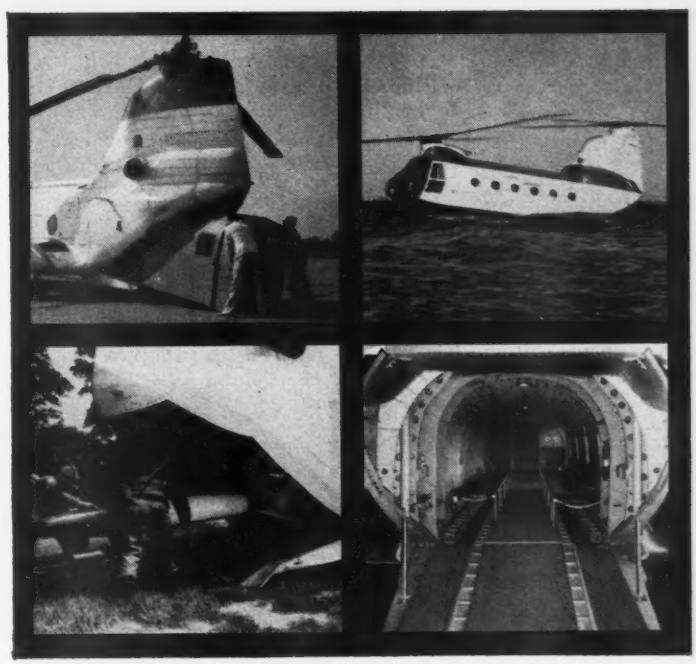
THE WORLD'S ONLY "MISSION MODULE" HELICOPTER

SIGNIFICANT FACTS ABOUT THE 107's WATER CAPABILITY

In the 107 helicopter, water landing capability has been achieved without special flotation equipment or the weight or drag penalties of floats or boat hull. Thus over-water operation can be carried out in full confidence that, should it be necessary, water landings and take offs can be made safely. The helicopter's fuselage possesses good water-taxiing characteristics. Flotation is assured by a factory-sealed fuselage of unique, flexible design; and a remarkable degree of lateral stability is provided by extended stubs on either side of the fuselage that house landing-gear support structure and fuel tanks. Elevated mounting of the rear rotor permits descent and landing in a nose-up flared attitude of as much as 30 degrees with no change in fuselage attitude required before touchdown. This is important in water landings at night, in low visibility or on glassy seas.

The "mission module" versatility of the Boeing-Vertol 107 means a high potential of all-around usefulness in operations. For example, pre-packaged, "plug-in" modules for anti-submarine warfare, minesweeping and rescue missions can be installed internally in a matter of minutes between flights. In addition, the same aircraft can tow, lift or carry heavy or bulky loads externally. Cargo of more than two tons can be speedily loaded or unloaded in the fuselage via the full-width rear ramp.

Along with its water landing capability and "mission module" versatility, the 107 offers the reliability of twin-turbine power. All in all, it is one of the most tactically and logistically useful aircraft available to the Armed Forces.



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News,
Views
& Comments

AEROSPACE WORLD

Frederic M. Philips
ASSOCIATE EDITOR, AIR FORCE MAGAZINE

Alan Bartlett Shepard Jr., Navy Commander and Mercury Astronaut, crossed the new frontier into space on May 5. Boosted by a Redstone rocket, he arced 302 miles over the Atlantic from Cape Canaveral in a Mercury man-in-space capsule, landed safely at sea a quarter of an hour later, and was picked up by a helicopter from the aircraft carrier *Lake Champlain*. Upwise, Commander Shepard reached an altitude of 115 miles during his flight.

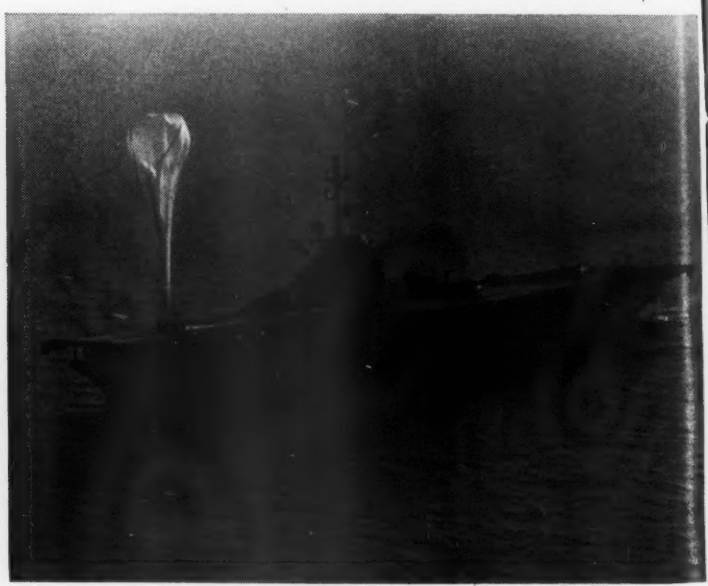
Thus, three weeks and two days after Russian orbiter Yuri Gagarin became history's first man in space, a brave young American had carried the Stars and Stripes into the wild black yonder. The flight, described and pictured in detail elsewhere in this issue, had an immediate tonic effect on a cold-war-weary nation's sagging ego. Cuba, Laos, a stubborn depression, Russia's very spatial challenge to the free world—all were swept aside for the moment as America cheered its first spaceman, sighed with relief that the publicity-spotlighted shot had gone so well, and felt some portion of an old-time national pride edge back into its consciousness. When Commander Shepard came to Washington three days later, on May 8, to receive national honors, a quarter of a million persons turned out to roar their greetings. The giant welcome spoke for men and women across the United States.

At the same time, on the sober side, Commander Shepard's pioneer shot was just that—no more. If we as a nation had crossed a new frontier, the wilderness road remained before us. And our bitter rivals as this modern age of exploration commenced were still a leap ahead. As a result of superior Russian rocket capability, Cosmonaut Gagarin's flight compared more than favorably with Astronaut Shepard's: 188 miles up compared to 115; 17,500-mph speed to 5,160; a 26,000-mile orbital trip against a 302-mile ballistic hop; 108-minute duration to fifteen minutes.

Some experts, it was known, felt that the Mercury ballistic shot should never have taken place, that it was something of a "circus stunt" with minimal real value to space development. Others felt we should turn our attention away from the rocket-capsule approach and accelerate development of a highly maneuverable aerodynamic spacecraft—a space plane. In the main, however, authoritative opinion in the aftermath of America's first manned space trip was this: We have passed an early milestone in space development. It is a proud achievement but not in the full sense a "victory." The space race is well joined. The alternatives of victory or defeat are as real today as in less technically advanced

—Wide World Photos, Inc.

President Kennedy pins NASA Distinguished Service Medal on lapel of America's first man in space, Navy Cmdr.-Mercury Astronaut Alan B. Shepard, Jr., in ceremony in nation's capital May 8. Three days earlier, Commander Shepard performed Mercury ballistic hop over Atlantic.



—Official US Navy Photo

Navy Cmdr. Malcolm Ross, Lt. Cmdr. Victor Prather set new balloon altitude mark of 21.5 miles on May 4 in ascension over Gulf of Mexico. Latter balloonist lost his life in recovery accident after descent. Above, aircraft carrier *Antietam* gets set to release the giant balloon.

eras, prospective results of national defeat just as grim as in the days of the ancients.

What lies in the immediate future? For us: Probably one or two more ballistic shots, an orbital shot this year or early next, all the while development of rockets competitive with the Russians in the Saturn and Nova programs. For the Reds: Presumably an effort to place a Soviet man on the moon. With a true crash program, it was generally agreed, we could catch and pass the Russians in space capabilities during this first decade of space exploration. Commander Shepard's flight, a distinguished achievement in itself, could prove more than a milestone in the long view of history. It could, and should, stimulate the national space effort as nothing in the past has quite been able to do.

☆

Two Navy balloonists ascended to a record altitude of 113,500 feet over the Gulf of Mexico on May 4, the day before the Mercury ballistic shot. One of them lost his life in a helicopter recovery accident following descent.

The two record-setters were Cmdr. Malcolm Ross, veteran balloonist-scientist who has logged more than 100 hours in the stratosphere, and Lt. Cmdr. Victor A. Prather, Jr., a medical observer. Their balloon was released from the deck of the aircraft carrier *Antietam* some forty miles south of the Mississippi delta. They rode an open gondola to the record height, about 21.5 miles, in an hour and a half. The balloon was forty stories high, contained ten million cubic feet of helium.

Previous open-gondola record of 102,800 feet was set by Air Force Capt. Joseph W. Kittinger, Jr., in August 1960. Captain Kittinger parachuted from his gondola after it attained peak altitude, thus establishing the existing mark in that regard. The Ross-Prather ascent provided conditions for checkout of a new high-altitude pressure suit and various other tests at altitude. Then the balloononauts descended according to plan, landing in the Gulf near the carrier. A waiting helicopter lowered a sling, hauled Commander Ross out of the water just as another chopper was to recover Astronaut Shepard the next day. Moments later, Lieutenant Commander Prather fell from the sling as he was being hoisted up. Unconscious, he was pulled from the water, taken back aboard ship, died an hour and a half later of drowning.

In other major missile-and-space events this month:

★ The **X-15** continued along its ever-higher and ever-faster way. USAF Maj. Robert M. White zoomed to 3,074 mph on April 21 at Edwards AFB, Calif., bettering his own 2,905 mph of March 7. Three thousand mph, it might be noted, is fifty miles a minute. The Air Force test pilot reported some "minor troubles" in the test flight: He had trouble starting the engine after release from the B-52 mother plane at an altitude of 45,000 feet; the craft fell to 38,000 feet before it started up. An air leak developed in the cabin at 95,000 feet, but the pilot's suit automatically inflated to protect him against decompression. Highest altitude on the flight was 103,000 feet, well under the record 169,000 feet reached by NASA X-15 pilot Joe Walker on March 30.

★ USAF fired a **Titan ICBM** from an underground silo for the first time on May 3 at Vandenberg AFB, Calif. The first such launch in US history, it proved out the concept of hardened, in-silo launching. Such launching capability would allow missiles to stand ready for instant use and at the same time enjoy maximum protection against enemy attack. The May 3 Titan roared from its 146-foot-deep concrete silo out of a cloud of smoke and flame and performed a programed 350-mile flight over the Pacific. The missile used in the test was a near-operational Titan I, which normally would ride an elevator from its storage silo before firing. This one was especially adapted for underground firing to provide data for development of Titan II, advanced and more potent version designed for in-silo launch.

★ NASA sent up its **Explorer XI** satellite, which it called a "space telescope," with a Juno II booster on April 27 at the Cape. It was the world's first astronomical satellite aimed to measure gamma rays unhampered by the effects of the earth's atmosphere. Gamma rays are high-energy particles emitted from cosmic sources such as the Milky Way and other galaxies of stars. Scientists believe these rays could be keys to information about elements in the universe. The Explorer XI shot was said to be the beginning of a long-range program in this area. The satellite was put in an orbit 301 miles from the earth at its closest point and 1,111 miles out at the farthest. It was the thirty-ninth satellite put up by the US since the first, Explorer I, in January 1958. The Russians have orbited fourteen satellites, including the Gagarin spaceship in April.

★ A new two-component bomb-and-fuel pod for the **B-58 Hustler** bomber underwent successful tests in flights from Kirtland AFB, N. M. B-58s in service with the Strategic Air Command are designed to carry their nuclear bombs and some of their fuel in disposable pods beneath the fuselage. The newer model in the tests consists of a small bomb pod nested above a large fuel pod. When external fuel is expended the pilot can drop the lower pod compartment and continue on to target, using fuel in wing tanks. Tests were conducted at altitudes of 1,000 to 40,000 feet, at speeds up to Mach 2.

★ Italian Air Force personnel in training at the Cape fired at least one **Jupiter IRBM** successfully down the Atlantic Missile Range this month.

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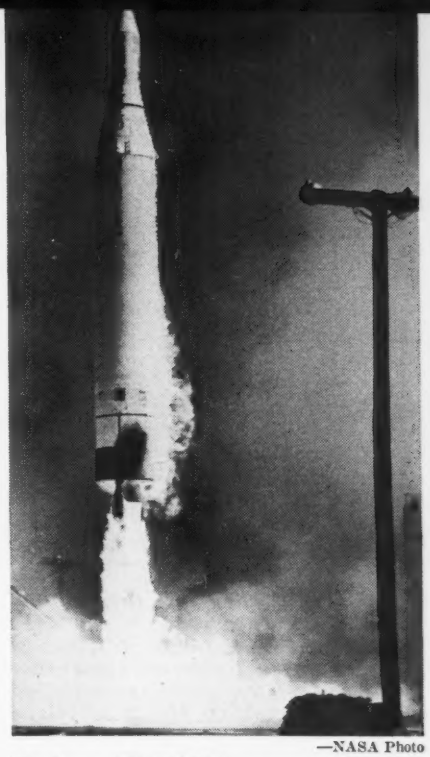


—NASA Photo

Explorer XI, NASA's astronomical satellite designed to gather data on gamma rays, blasts off from Cape Canaveral April 27, carrying instrument payload of seventy-five pounds.

The new Chief Scientist of the Air Force, Dr. Leonard S. Sheingold, formerly of Sylvania, named this month.

Hundreds of former pilots of World War II P-47 fighter, a rugged and well armed plane that outfought enemy aircraft around the world, gathered at Republic Aviation plant in New York on May 2 to celebrate twentieth anniversary of "good old days" in Thunderbolts, or "Jugs."

Another old airplane comes home to the Air Force Museum at Wright-Patterson AFB, Ohio. Capt. A. S. Hill, right, hands papers on old B-18 bomber to Mark C. Sloan, museum director, as Maj. J. F. Campbell looks on. The museum has impressive, ever-expanding collection of US warplanes.

B-58 Hustler with a new two-component pod is readied for flight. This improved twin pod permits pilot to dump bottom part designed for fuel when its contents are exhausted, while retaining upper, bomb-bearing component for a lighter-weight streak to the bomber's target.

Jupiters are being emplaced in Italy. Thor IRBMs have been on site in Great Britain for the past two years. British Royal Air Force crews have received continuing training in this country to man the sites.

☆

As new East-West arms talks droned and shuffled in uninspiring fashion at Geneva, disarmament dialogue took an interesting turn in Washington. Minnesota Sen. Hubert H. Humphrey, head of the Senate Disarmament Subcommittee, a proponent of energetic government action in the direction of disarmament, and a born optimist, reached some pessimistic conclusions. Senator Humphrey declared in a late April speech that Russia "has poisoned the climate for successful disarmament negotiations."

"The evidence mounts," Mr. Humphrey said, "that the primary interest of the Soviet Union is to disarm the rest of the world and not itself. It intends to weaken the strength and resolution of the free world as it builds its own strength.

"The Soviet Union would disarm the world not through negotiation, but by fear—not through agreement, but by threat.

"It is apparent that the Soviet Union is less interested in constructive discussion and negotiation than in sparking turmoil, disorder, and revolution.

"The number-one tactic of the Soviet Union to disarm the rest of the world is to strip the United Nations of its power and authority. . . .

"In recent months, the Soviet Union has intensified the cold war—through guerrilla action in one country, deceitful propaganda in another, subversion in all."

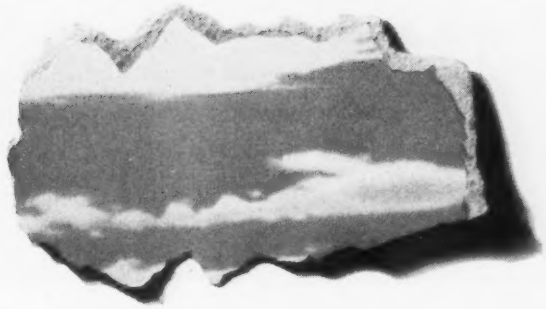
Mr. Humphrey's solution was a strengthened United Nations with power to meet the Soviet challenge: "We must work to strengthen the United Nations, to arm that organization as a center of power to assure law and order. We must arm the United Nations with an adequate budget, with full support for the Secretary General, with enough personnel for its mission, and—indeed—with an effective police force."

☆

The grand old man of flight design and research, Dr. Theodore von Kármán, reached the grand old age of eighty on May 11. Little known outside the aerospace community, Dr. Von Kármán has for many years been a major figure in aviation and space development. His influence, in fact, permeates today's thinking throughout the world in the vital fields of solid and fluid mechanics and propulsion. Currently chairman of the Advisory Group for Aeronautical Research and Development (AGARD) of NATO, honorary president of the International Council of the Aeronautical Sciences, and long-time Air Force consultant, Dr. Von Kármán was instrumental in the creation of the Air Force Office of Scientific Research. The mandate he set for AFOSR, critically important for the modern Air Force, called for unremitting effort to seek out new aerospace horizons through contracts for basic research by universities, foundations and other nonprofit groups, and industrial laboratories throughout the free world.

Dr. Von Kármán's eightieth birthday was marked in Washington by a symposium and banquet in his honor. They were sponsored by AFOSR and the Institute of Aerospace Sciences.

(Continued on page 31)



Problem for Skybolt: Where is this patch of sky?

To calculate its trajectory to target, Skybolt air-launched ballistic missile will have to know precisely where it is at any given moment, day or night. This problem is neatly solved by the star tracking capability of its Astronertial guidance system, which can provide an instantaneous fix on any piece of sky the mother plane passes through. When Skybolt is operational, the guidance system will put it into a ballistic trajectory after launch, to deliver the warhead on target up to 1000 miles away.

This versatile stellar-monitored inertial guidance system is being designed and built by Nortronics for the USAF-Douglas Skybolt, now under development.

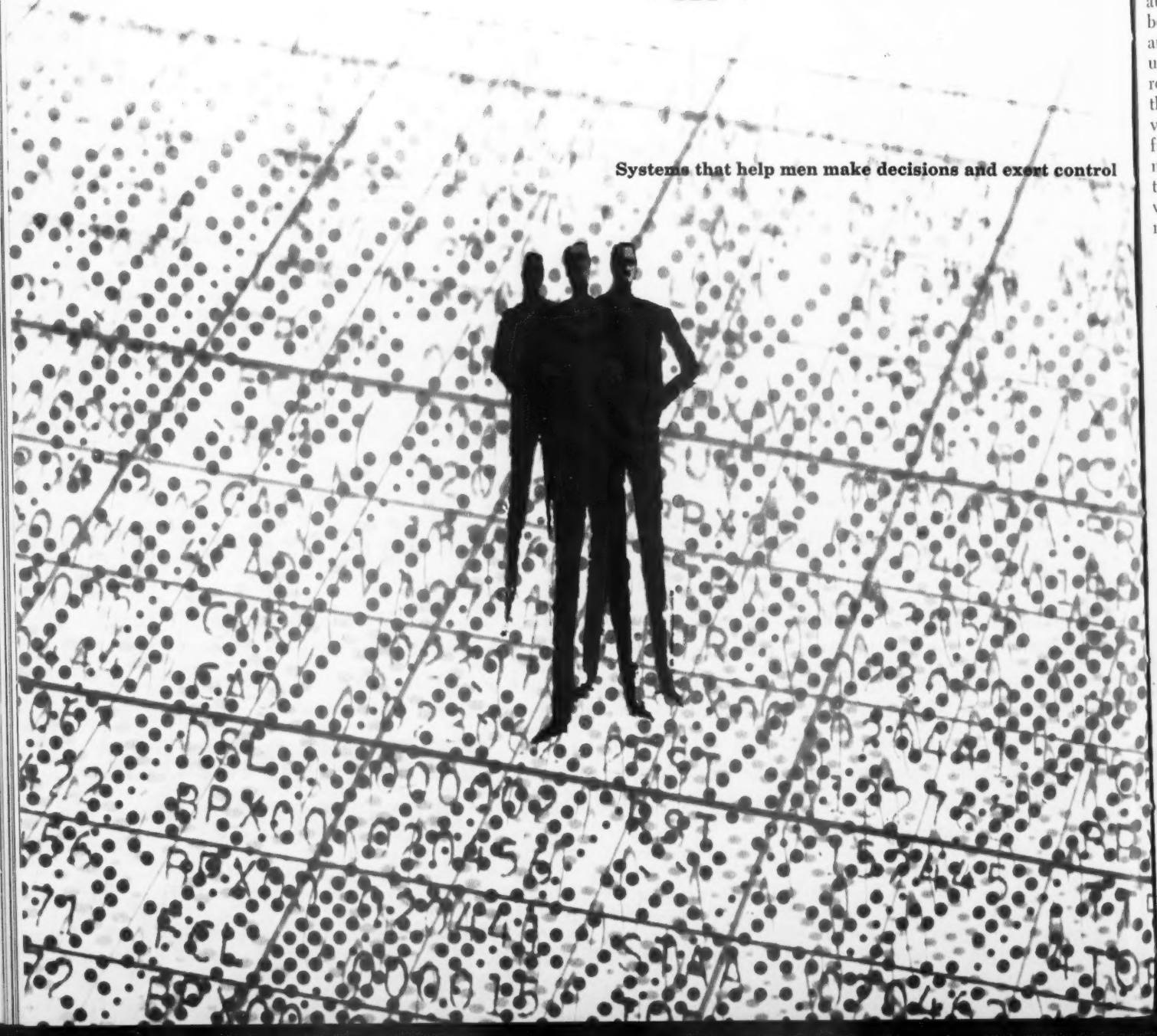
NORTRONICS
A DIVISION OF
NORTHROP

New Powers of Decision for Men in Command

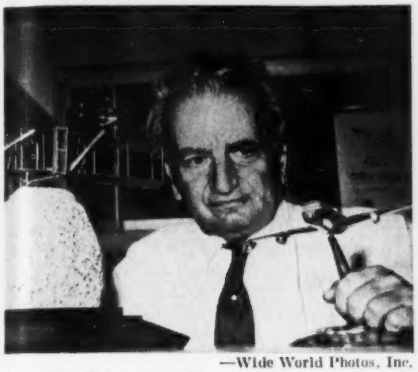
For military commanders and governmental leaders this is a new era of decision and control. Many of their decisions and actions must be made with great speed as events occur. They must be based on huge amounts of information. And they affect world-wide and continental forces. To help command groups exercise their powers of decision and control, a new technology has been developed—large-scale systems that involve automated information processing assistance. ■ Acting in the public interest, we have made major contributions to a number of these systems. SAGE was the first. The SAC Control System is in development. And we are beginning work on two other extremely large systems. Our main efforts are in analysis and synthesis of these systems, training men for their use, instructing great computers on which the systems are based—and research into future generations of these systems. ■ In developing these systems we follow a close interdisciplinary approach. Operations Research, Engineering, Computer Programming and Human Factors are the essential disciplines. Our expanding programs have created a number of new positions at our facilities in Santa Monica, Calif., Lexington, Mass., Washington, D.C., and Paramus, N.J. Inquiries are invited from those who wish to contribute to this new technology. ■ All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin. ■ Address Mr. Robert L. Obrey, SDC, 2423 Colorado Ave., Santa Monica, Calif.

SYSTEM DEVELOPMENT CORPORATION

SDC



Systems that help men make decisions and exert control



—Wide World Photos, Inc.

Feted this month on his eightieth birthday was Dr. Theodore von Kármán, often called aviation's Einstein.

New and welcome members of the Air Force Association are these men of the Air Force's 7415th Headquarters Support Squadron (USAFE FLO) at Orly Airport, France. Twenty-six members of the unit have joined the AFA worldwide family.

The day before, Dr. Von Kármán told newsmen at a press conference that he would like to see manned aircraft designed to go to "great altitudes at great speeds." He said this would be a much cheaper way of getting men and other payloads into space than using one-shot, highly expensive rockets. He also said he didn't think that Russia's state of missile-space advance at present was dangerous to the free world. War is unlikely in the next few years, he judged, and after that the US should have operational warning satellites and, it is hoped, manned orbital spacecraft.

☆

ELSEWHERE IN THE AEROSPACE WORLD:

Claude Witze, Senior Editor of AIR FORCE/SPACE DIGEST, was honored for excellence in writing in aviation publications. The Aviation/Space Writers' Association, at their annual convention, cited Mr. Witze for his article "The Challenge to Aviation in the Cold War," in the January '61 issue of this magazine.

France staged its fourth Sahara nuclear test explosion April 25.

Dr. Leonard S. Sheingold, formerly a member of USAF's Scientific Advisory Board and Director of Applied Research for Sylvania Electronic Products, was named USAF Chief Scientist. He succeeded Dr. Alexander Flax, who returns to the Cornell Aeronautical Laboratory.

Dr. Edward L. Katzenbach, formerly of USAF's Electronics Directorate, Bedford, Mass., was chosen DoD Deputy Assistant for Education and Manpower Resources.

The freak accident in which a Sidewinder missile inadvertently loosed from an F-100 shot down a B-52 last month has been ascribed to "malfunction when moisture seeped into an electric connector plug." Steps were taken to prevent such mishaps in the future (*see "Ready Room," page 101*).

Air Force planes, including C-130s, F-102s, KC-135s, B-47s, and B-52s, have been operating from a 14,000-foot runway of natural ocean ice off Thule, Greenland. This and nearby parking pads have been constructed under Project Iceway, a research program to explore the use of thick ocean ice in polar regions for airfields. These regions take on ever-increasing strategic significance.

The Carnegie Medal for Heroism went to Link Luckett, the young Alaskan who flew a Hiller 12E light helicopter to a record 19,300 feet in May 1960 to execute the perilous rescue of two injured mountain climbers on Alaska's snow-covered Mt. McKinley.

The Air Force plans to use QB-47s, unmanned drone B-47s, for low-altitude tests of the SAGE air defense network.

Hundreds of former P-47 pilots assembled at Republic Aviation on Long Island, N. Y., on May 2 to celebrate the twentieth birthday of the Thunderbolt, or "Jug," fighter of World War II (*see page 118 for full report*).

Approximately eighty Air Force Academy Cadets have volunteered to take part in a three-week basic airborne course at the Army's Infantry Center, Fort Benning, Ga., this summer. Those who graduate will receive the Army Parachutist's Badge. This year's training will mark the fourth year the Cadets have enrolled in the course at the Army School. The school has awarded 119 Parachutists' Badges to the USAF Cadets.

A Japanese rocket expert revealed that his country hoped to launch its first satellite into space in 1965. He said that Japanese scientific and development work was moving forward with this goal in mind. Japanese scientists planned to send monkeys on rides in three-stage "Lamba" rockets this fall.

STAFF CHANGES . . . Brig. Gen. Ernest H. Beverly, from Commander, Washington Air Defense Sector, ADC, Ft. Lee AF Station, Va., to Commander, 39th Air Division PACAF, APO 953, San Francisco, Calif. . . . **Brig. Gen. Richard F. Bromiley,** from Commander, 1501st Air Transport Wing (H), MATS, to Deputy Commander, WESTAF, MATS, Travis AFB, Calif. . . . **Maj. Gen. Daniel F. Callahan,** from Commander, Mobile AMA, AFLC, Brookley AFB, Ala., to Director of Logistics (J-4), The Joint Staff, JCS, Hq. USAF, Washington, D.C. . . . **Maj. Gen. John W. Carpenter,** from Commander AF Flight Test Center, AFSC, Edwards AFB, Calif., to Deputy Director, Plans, DCS/Plans and Programs, Hq. USAF, Washington D.C. . . . **Maj. Gen. John B. Cary,** from DCS/Plans and Operations, Hq. PACAF, APO 953, San Francisco, Calif., to Assistant to the Commander, Hq. Command, USAF, Bolling AFB, Washington, D.C. . . . **Brig. Gen. James W. Chapman, Jr.,** from Commander, 4510th Combat Crew Training Wing, TAC, Luke AFB, Ariz., to Commander, 1501st Air Transport Wing (H), MATS, Travis AFB, Calif.

Brig. Gen. Edwin S. Chickering, from Commander, 6484th Air Base Wing, PACAF, APO 953, San Francisco, Calif., to SAF Personnel Council, OSAF, Hq. USAF, Washington, D. C. . . . **Brig. Gen. Thomas R. Ford,** from Deputy for Operations, Hq. Ninth AF, TAC, Shaw AFB, S. C., to Commander, 41st Air Division, PACAF, APO 994, San Francisco, Calif. . . . **Brig. Gen. Kenneth H. Gibson,** from Commander, Chicago Air Defense Sector, ADC, Truax Field, Wis., to Commander, Washington ADS, ADC, Ft. Lee, Va. . . . **Maj. Gen. Donald P. Graul,** from Commander, Rome Air Development Center, AFSC, Griffiss AFB, N. Y., to Deputy Commander, AF Communications Service, Scott AFB, Ill. . . . **Brig. Gen. Philip H. Greasley,** from Chief, USAF Group, Joint Military Mission for Aid to Turkey, to Deputy Commandant, Armed Forces Staff College, Norfolk, Va. . . . **Brig. Gen. Edgar W. Hampton,** from Deputy Commander, WESTAF, MATS, Travis AFB, Calif., to Director of Transportation, DCS/Materiel, Hq. USAF, Washington, D. C. . . . **Brig. Gen. Earl C. Hedlund,** from Director of Transportation, DCS/M, Hq. USAF, Washington, D. C., to Deputy Commander, Ogden Air Materiel Area, AFLC, Hill AFB, Utah. . . . **Brig. Gen. Travis M. Hetherington,** from Commander, 39th Air Division, PACAF, to DCS/

(Continued on following page)

THIS IS THE "FIRST TEAM"

in aerial target scoring systems

This team of weapons training specialists, which provided the military air services of the United States and Canada with the only operationally proven scoring device for air-to-air ballistic rockets, has now developed the first PASSIVE MISS-DISTANCE-INDICATING SYSTEM that meets the following requirements:

- Scores irrespective of missile size and velocity
- Requires no modification of weapons
- Is accurate within 10%
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This is another breakthrough from Del Mar, where the defense of the free world is our business.

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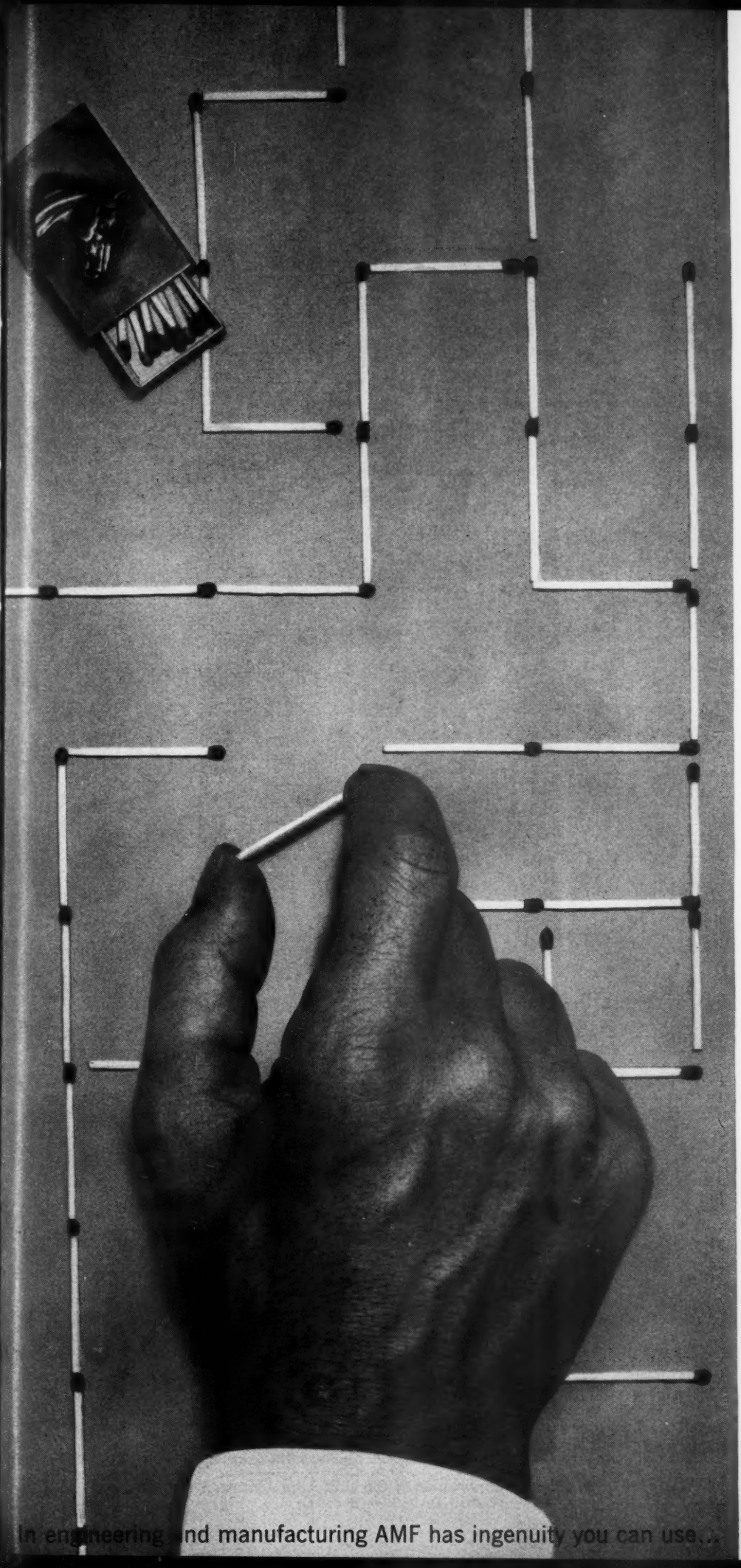
INTERNATIONAL AIRPORT LOS ANGELES 45, CALIF.

Plans and Operations, Hq. PACAF, APO 953, San Francisco, Calif. **Brig. Gen. George M. Higginson,** from Deputy Chief of Staff for Operations, USAF Security Service, San Antonio, Tex., to Assistant Director, National Security Agency, Ft. Meade, Md.

Brig. Gen. John M. Hutchison, from Deputy Commander to Commander, 314th Air Division, PACAF, APO 970, San Francisco, Calif. . . . **Maj. Gen. James C. Jensen,** from Commander, 30th Air Division (SAGE), ADC, Truax Field, Wis., to DCS/Operations, ADC, Ent AFB, Colo. . . . **Brig. Gen. James C. McGehee,** from Commander, 2d Air Division and Chief, US Military Training Mission to Saudi Arabia, to Commander, 1001st Air Base Wing, Hq. Command, USAF, Andrews AFB, Washington, D. C. . . . **Maj. Gen. Theodore R. Milton,** from Commander, 41st Air Division, PACAF, to Commander, 13th AF, PACAF, APO 74, San Francisco, Calif. . . . **Maj. Gen. Dolf E. Muhleisen,** from DCS/Plans and Policy (J-5), 4608th Support Squadron ADC, Ent AFB, Colo., to Commander, 29th Air Division (SAGE), ADC, Richards-Gebaur AFB, Mo. . . . **Maj. Gen. Conrad F. Necrason,** from Commander, AAC, APO 942, Seattle, Wash., to Commander, 30th Air Division (SAGE), ADC, Truax Field, Wis. . . . **Brig. Gen. Harold L. Neely,** from Deputy Commandant, Armed Forces Staff College, Norfolk, Va., to Commander, Los Angeles ADS, ADC, Norton AFB, Calif. . . . **Brig. Gen. Henry C. Newcomer,** from Commander, 7217th Air Division, USAFE, APO 254, New York, N. Y., to Commander, Seattle ADS, ADC, McChord AFB, Wash. . . . **Maj. Gen. Romulus W. Puryear,** from DCS/Operations, ADC, Ent AFB, Colo., to DCS/Operations, Hq. USAFE, APO 633, New York, N. Y. . . . **Brig. Gen. James L. Riley,** from Deputy Director, SAF Personnel Council, Hq. USAF, Washington, D. C., to Commander, ARRC, Denver, Colo.

Brig. Gen. John A. Rouse, from DCS/Plans, Programs and Operational Services, ATC, Randolph AFB, Tex., to Commander, 6484th Air Base Wing and 326th Air Division, PACAF, APO 953, San Francisco, Calif. . . . **Brig. Gen. James C. Sherrill,** from Chief of Staff, MATS, Scott AFB, Ill., to Commander, 1608th Air Transport Wing (H), MATS, Charleston AFB, S. C. . . . **Brig. Gen. William T. Smith,** from Commander, 1001st Air Base Wing, Hq. Command, USAF, Andrews AFB, Washington, D. C., to Chief of Staff, AFCS, Scott AFB, Ill. . . . **Brig. Gen. William S. Steele,** from Deputy Director, Military Assistance Division, US European Command, APO 128, New York, N. Y., to Deputy Director for Military Assistance, Central Control Group (OSD), Hq. USAF, Washington, D. C. . . . **Brig. Gen. James B. Tipton,** from Commander, 314th Air Division PACAF, APO 970, San Francisco, Calif., to Commander, Chicago ADS, ADC, Truax Field, Wis. . . . **Brig. Gen. Tarleton H. Watkins,** from Commander, 322d Air Division, USAFE, APO 253, New York, N. Y., to Deputy for Operations, Ninth AF, TAC, Shaw AFB, S. C. . . . **Maj. Gen. William H. Wise,** from Commander, 322d Air Division (SAGE), ADC, Dobbins AFB, Ga., to DCS/Plans and Policy (J-5), North American ADC and Continental ADC, Ent AFB, Colo.

RETIRED: Brig. Gen. Frederick **Bell,** Brig. Gen. Clarence T. **Edwinson.**—END



He designed a new interchange for radio traffic

This AMF engineer, part of an AMF-U.S. Army team, solved the problem of traffic delays and personal danger in manual re-connection of jumpers when interchanging R.F. transmitters and antennas.

His solution is a push-button-operated, coaxial crossbar switching system, using vacuum switches for circuit selection. A typical system consists of 4 transmitter inputs, 7 antenna outputs plus a dummy load, in a 4 x 8 matrix that can be mounted in a 19″ rack. It can be controlled locally or remotely over any type of communication network having a bandwidth of at least 200 cycles.

AMF's coaxial crossbar switching system provides 100% flexibility in circuit path selection and accommodates power levels as high as 500,000 watts and frequencies up to 30 megacycles. It allows 100% utilization of all transmitting equipment. Stubs are automatically eliminated.

To insure fail-safe operation, power is required for the vacuum switches *only* during change of condition. Selection rate: 1 per second. Operating transmitters are safety-interlocked to insure a load. There are no hazards from open wires or inadvertent application of power to dead-lined antennas.

Single Command Concept

AMF's imagination and skills are organized in a *single operational unit* offering a wide range of engineering and production capabilities. Its purpose: to accept assignments at any stage from concept through development, production, and service training...and to complete them faster...in

- *Ground Support Equipment*
- *Weapon Systems*
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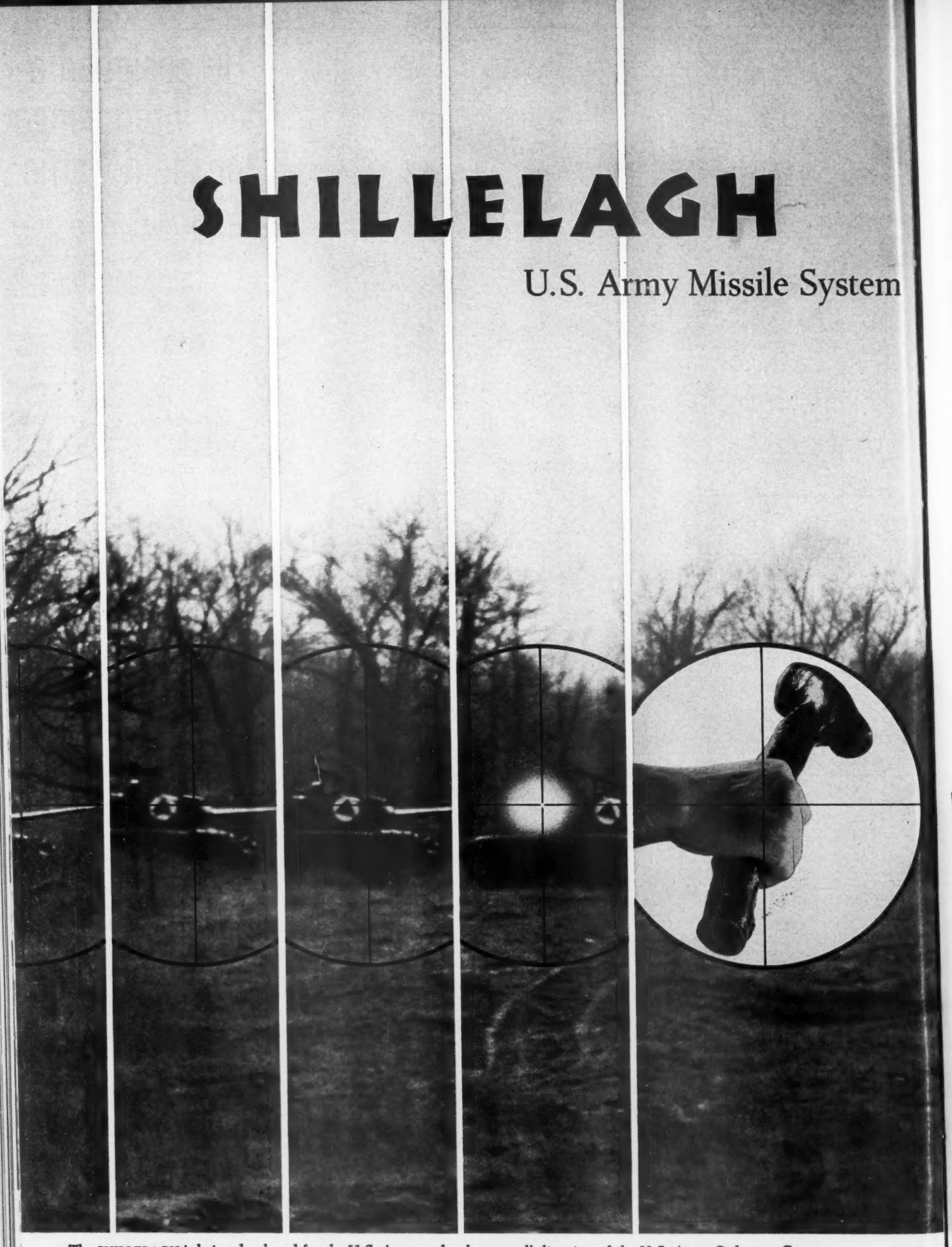
In engineering and manufacturing AMF has ingenuity you can use...

SHILLELAGH

U.S. Army Missile System



The **SHILLELAGH** is being developed for the U.S. Army under the over-all direction of the U.S. Army Ordnance Corps.

The United States Army SHILLELAGH surface-to-surface guided missile–like its Irish namesake–will be simple, reliable... lethal. Against enemy targets–moving or stationary–**SHILLELAGH's** accuracy and firepower will provide the U.S. Army a devastating new weapon that kills with a first-round probability approaching unity ...and at ranges never achieved in antitank warfare. **SHILLELAGH** is now under development at Aeronutronic, prime contractor on this advanced weapon system.

AERONUTRONIC DIVISION *Ford Motor Company*, DEFENSE PRODUCTS GROUP
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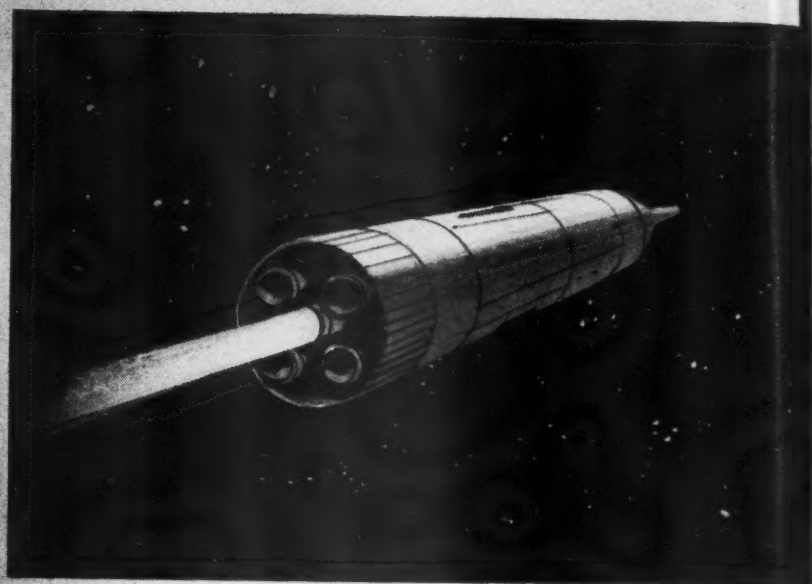
SHILLELAGH is one of many advanced programs currently under development at Aeronutronic's new, million-square-foot Engineering & Research Center at Newport Beach in Southern California.

Write for information about Aeronutronic's capabilities and career opportunities now open for engineers and scientists.



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ROVER— THE NUCLEAR WAY TO SPACE

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AIR FORCE
JUNE 1961

A nuclear rocket would play an immensely important role in our space program. Such a rocket is under development in the NASA-AEC Project Rover. But, at present, fiscal problems stand in Rover's way . . .

J. S. Butz, Jr.
TECHNICAL EDITOR, AIR FORCE MAGAZINE

Afterburners are being considered to augment the thrust of the first Rover-type nuclear rockets. Early flight reactors will be relatively small. If used in "conventional" rockets their thrust will be in the 100,000-200,000-lb. range. NASA studies show that afterburners can increase the thrust 10 to 15 times into the multimillion-lb. class. After high-thrust boost phase (left) extra afterburner nozzles would be shut off and power reduced (inset).

IN ONE respect the nuclear rocket is unique among technical projects—in its essentials it is unanimously supported by both the scientific and engineering communities.

Most experts not only refrain from criticizing the Rover-type nuclear rocket (Rover itself is now a NASA-AEC project), but the vast majority consider it to be the cornerstone of a successful space program. There are virtually no dissenters. Liquid-propellant rocket enthusiasts, solid-rocket proponents, airframe manufacturers, space-medicine specialists, and civil and military space planners have all pressed for the earliest possible construction of a flyable nuclear rocket. Nowhere else in the myriad of space vehicle and propulsion schemes can there be found such unanimity of approval.

There is a compelling technical reason for this support. It is simply impossible to argue that nuclear rockets are not the best and cheapest means of performing any space mission involving large payloads. By contrast, opponents could argue with at least some effect against other nuclear-propulsion programs—including the nuclear plane. Many space missions, such as manned voyages to the planets, cannot be rationally considered without planning on the use of nuclear rockets.

The most elementary nuclear systems will carry two to four times the payload of the best chemical-fueled machines, given the same launch weight for both. If a fixed-weight payload is considered, the use of nuclear rockets will materially reduce the size and the number of stages required for a space vehicle.

For example, it would require a six-stage vehicle with 10.5 million pounds of thrust in the booster to put a 15,000-pound payload on the moon and return it to the earth. If one nuclear stage were used in the vehicle, its booster would only have to produce 4.5 million pounds of thrust, and only five stages would be needed. If two nuclear stages could be used, the booster thrust could be reduced to three million pounds, and the vehicle would need only four stages.

No one contends, it must be noted, that developing an operational nuclear rocket will be easy or that it can be ready to go in much less than seven years after an all-out development program is initiated. However, some of the most distinguished scientists in the Atomic Energy Commission regard the development of the Rover-type nuclear rocket as an "enormously" easier task than the construction of either the atomic or the hydrogen bomb. This opinion was expressed over three years ago by Dr. Stanislaus Ulam, who with Dr. Edward Teller is regarded as a prime figure in the development of the hydrogen bomb, and by Dr. Norris Bradbury, Director of the Los Alamos Scientific Laboratory, in testimony before the Congress.

In January of 1958, Dr. Bradbury told the joint Committee on Atomic Energy that "the obstacles to be overcome in the first atomic and the hydrogen bomb seem now to be very large compared to the obstacles one has to overcome in going about nuclear propulsion [the nuclear rocket] and ramjet." Dr. Ulam concurred at the same hearing.

The top-priority Manhattan Project to produce the A-bomb began shortly after Pearl Harbor. It was pursued with the greatest urgency because a handful of nuclear physicists believed that its early success was vital to the safety of the United States. They were able to convince the Administration that they were correct.

The first bomb was exploded in July 1945 after about three and a half years of all-out effort costing about $2 billion. Hundreds of millions of dollars were spent to provide the necessary experimental and production facilities for a minimum-length program. Overall, some five and a half or six years had actually been required to build the bomb. A considerable amount of basic work on the bomb principles was done from 1939 through 1941 after Nils Bohr came to the United States with news of the first fission of uranium in Germany in 1939.

In contrast, the nuclear-rocket program was set up six years ago and has been operating on an extremely limited budget. Less than $150 million has been spent during the entire period. Many more than a handful of nuclear physicists and other scientists and engineers believe that the nuclear rocket could be as decisive in the exploration of space as the atom bomb was in World War II. Yet no one has been able to convince any Administration or its scientific advisers that it should have a high priority.

It is pretty well agreed that it would take $2 or $3 billion spent in a period of about five years to develop

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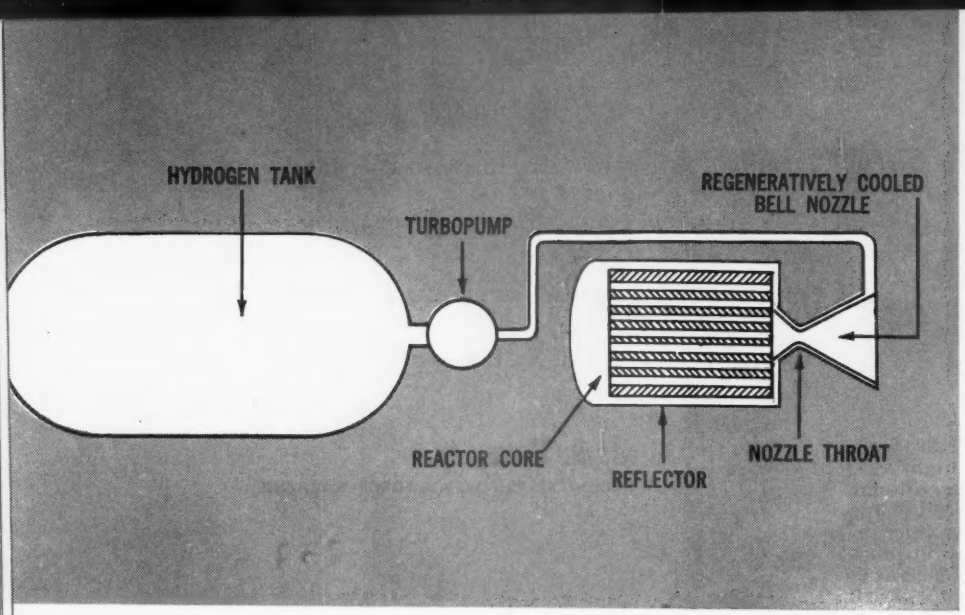
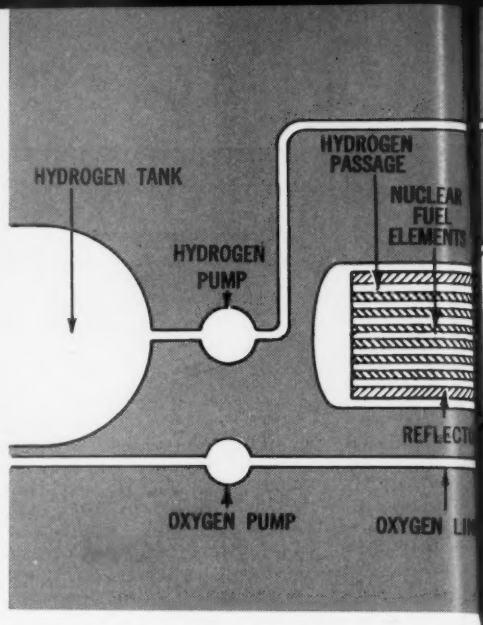


"Conventional" nuclear rocket has solid-fuel reactor with many parallel passages down its center. Hydrogen is forced through the passages, heated, and exhausted out of the bell nozzle to provide thrust. Shielding would be used around the reactor to prevent radiation damage and overheating of the turbopump, vehicle structure, etc. Shielded crew compartment on nuclear-powered space vehicle would be located on forward end as far as possible from the reactor. It would resemble the compartment developed for the nuclear airplane and would also provide protection against solar radiation.



Conceptual drawing of nuclear rocket with afterburner is shown above. Hydrogen and oxygen would be burned in the stream of hot hydrogen coming through the reactor. Increased mass flow would require auxiliary nozzles with complex valving arrangements. Cooling and power control would also be major problems in afterburner design.

and flight-test the nuclear rocket. This price tag apparently has kept the brakes on the program even though in 1958 the Eisenhower Administration publicly began acknowledging a serious lag in US rocket booster power relative to the Soviets. Eisenhower officials counted on the Saturn booster to put us ahead of the Russians.

President Kennedy has other ideas on Saturn. In a press conference, he said that it is "several years behind the Soviet Union," and that, "regardless of how much we spend on the Saturn, we are still going to be behind." He added that the rocket "does not offer any hope of being first to the moon."

The Kennedy Administration, accordingly, is seeking a new engine system to surpass the Soviets. But, perhaps surprisingly, no concrete move has been made to accelerate the nuclear rocket. The Eisenhower appropriations requests for the next fiscal year have been raised some, but the minimum requests of the project managers still have not been met. The sums of money in contention are very small. For instance, $15 million requested for the construction of another engine test stand and remote disassembly building was ruled against by the Kennedy Budget Bureau. It has been estimated that the loss of these facilities will delay the first flight of a nuclear rocket one year beyond the currently planned date of 1966 or 1967.

At this writing the Administration is still reviewing Project Rover amid growing criticism from the Democratic Congress. Rep. Melvin Price of Illinois, Chairman of the Joint Congressional Atomic Energy Subcommittee on Research, has said, "The lip service we are providing for the nuclear-rocket program, the target dates and long-range program statements being established regularly, are in reality steps to provide a decent burial for the nuclear-rocket program."

Mr. Price has also described what he regards as close parallels between the stretchouts endured by the nuclear-airplane program and the recent history of Project Rover. The Kennedy Administration canceled the nuclear-airplane program shortly after taking office.

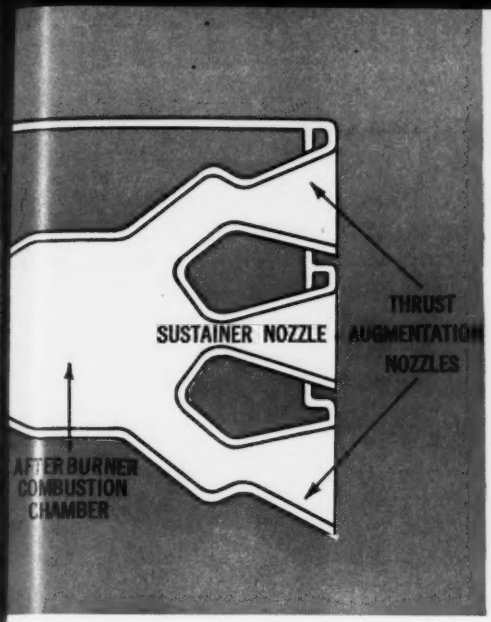
Other congressional leaders are withholding comment until they see what national goals are established after completion of a long-range study of the space problem being conducted by President Kennedy's advisers.

Regardless of the future actions of any branch of the government, it seems possible to sum up the current nuclear-rocket situation with two comments. First: No informed individual in the United States would want to be second in developing a reliable nuclear rocket. Second: It seems highly unlikely that the Soviets have spent *less* than the ruble equivalent of $150 million on nuclear-rocket development in the last six years.

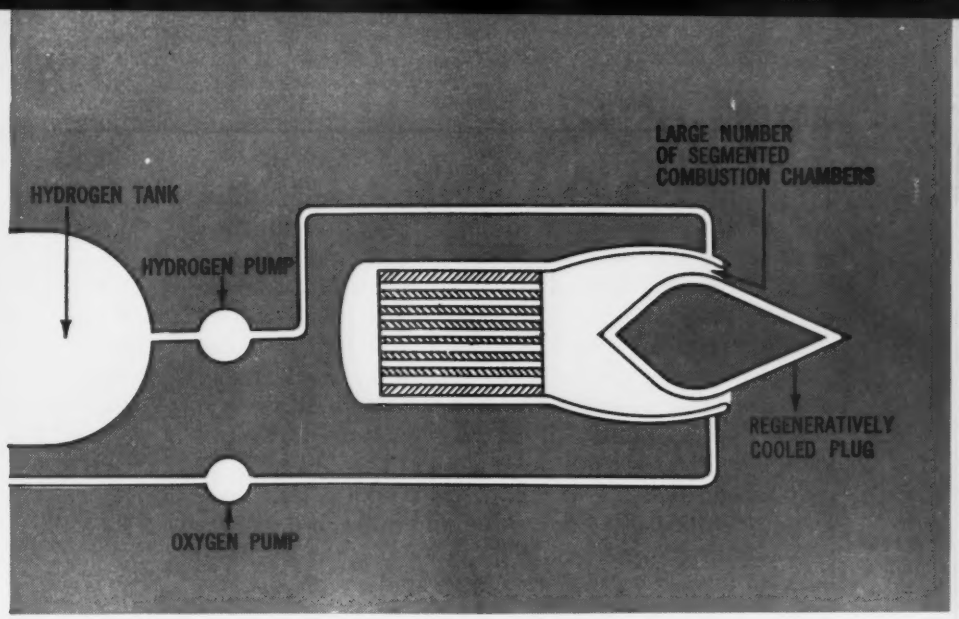
The first nuclear-rocket proposals were made to the government in the middle 1940s. By 1955 the AEC-funded scientific laboratories at Los Alamos and Livermore had small groups of scientists studying nuclear rockets and ramjets on a regular basis. This work depended to a great extent on the high-temperature material, heat-exchanger, and reactor physics research being accomplished under the aircraft nuclear propulsion program.

About September of 1955 the AEC asked the Department of Defense about their interest in forming a specific nuclear-rocket research program. DoD showed intense interest in such a project—as long as it did not interfere with weapon programs going on at Los Alamos and Livermore.

The Air Force was made the cognizant service. It immediately joined with the AEC to form Project Rover with the object of proving the feasibility of nuclear-rocket engines through ground operation of such a device by 1959. Flight tests were envisioned by 1965. Development of the reactor for this engine was the responsibility of the AEC under the existing laws. Other portions of the rocket, such as the nozzle and turbopump, were managed by the Air Force.



Biggest penalty in using afterburner is loss of high-specific-impulse characteristic of nuclear rockets. Under the worst conditions, the afterburning nuclear rocket still has higher specific impulse than hydrogen-oxygen chemical rocket. It is possible that the lightest thrust augmentation might be obtained by adding chemical rockets.



The plug nozzle offers a potentially simple method of varying the nozzle throat area on the afterburning nuclear rocket. Center plug would be held in place by slender struts which are lined up with the gas flow. The passages between these struts could be blocked off by simple knife valves. During maximum thrust augmentation all passages would be open. During low-thrust, high-specific-impulse flight at high altitude, nozzle efficiency would not drop significantly when most of the passages were valved off and small gas streams were exhausting in a symmetrical manner around the plug.

First delay in the program came about a year later when Charles E. Wilson, then Secretary of Defense, overruled some of his own advisers and asked Louis Strauss, then AEC Chairman, to slow Project Rover down. Wilson's letter to Strauss contained the following statements: "Careful study of . . . [the nuclear-rocket program] leads me to the conclusion that the dates suggested for the demonstration of reactor feasibility and flight tests are not realistic. . . . At my specific request, can the AEC continue on a moderate scale to develop a reactor suitable for nuclear propulsion of missiles, satellites, and the like?"

The technical people working on the program agreed that their original predictions had been optimistic, but only by about one year. They still believed in 1956 that feasibility could be proved by early 1960. To comply with the spirit of Wilson's request, however, the level of effort was reduced at the AEC. Feasibility date was put forward to 1962. No further plans were made for flight testing.

Enough work had been done by the beginning of 1958 to convince Dr. Ulam, Dr. Bradbury, and many others familiar with the program that the nuclear rocket was feasible. At that time, however, there was reason for these opinions to be questioned. The first Rover experimental reactor, the Kiwi-A, had never been tested, and its operating temperatures were much higher than any ever attained. Then, a year later, in 1959, came the first tests. Any doubts about their success were dispelled in March 1960 when Dr. R. E. Schreiber, technical head of the AEC's portion of Project Rover, told Congress that the ". . . use of heat-exchanger nuclear engines [Rover rockets] to propel space vehicles seems to be a matter of detailed engineering, money, and a determination to carry through such a project." Since that time two more Rover reactors—Kiwi-A prime and Kiwi-A3—have been tested successfully to further strengthen Dr. Schrieber's opinion.

The Rover management setup was altered in the summer of 1958 when the Air Force responsibility in the project was transferred to the National Aeronautics and Space Administration. Dr. Hugh Dryden, Deputy Administrator of NASA, has stated that the nuclear rocket is his agency's most important advanced propulsion program. This has not done much good as far as speeding the program is concerned. Congressional testimony has revealed every year that requests for Rover funds have been cut both in the AEC and the Budget Bureau.

This same pattern has been repeated by the Kennedy Administration. Total Rover appropriations requests for the AEC and NASA during the next fiscal year were $45.5 million by the Eisenhower government. The new Kennedy Administration added $14 million to this sum, but it was still $30.5 million short of the amount estimated by the project managers to be necessary if the first flight-test engine is to be ready by 1966-67.

It will, in fact, be impossible to sustain the Rover program at this funding level any longer. The fundamental research portion of Rover is just about over. Engine development, which means bigger money, must commence if the program is to be kept on the rails.

The NASA-AEC Space Nuclear Propulsion Office, which manages Project Rover, is now reviewing proposals by seven groups of companies to select a contractor team for the first flyable nuclear rocket. This will be the Nerva engine. The name derives from the words "Nuclear Engine for Rocket Vehicle Application." Announcement of the Nerva contractor is due about the first of July.

Large sums of money will be necessary to sustain this development program. It undoubtedly will be more costly than a chemical-engine development. Many ground firings of nuclear rockets will have to take

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place before the first one is flown. Heavy expenditures will have to begin in fiscal 1963, the first budgetary year completely within the province of the Kennedy Administration. Most of the criticism from Congress, such as that from Representative Price, stems from a seeming reluctance to begin these large expenditures.

Project Rover planners envision a sizable series of nuclear-rocket engines growing out of their present work. Fundamentally all of the engines in the series would operate in the same manner. They would employ a solid-fuel reactor about the size of a large garbage can with parallel holes running through it lengthwise. Hydrogen gas would be pumped through these holes to carry away the heat generated by the nuclear fuel. The hot hydrogen would then be exhausted out of a nozzle to provide thrust.

This basically simple scheme is complicated by the fact that the nuclear-fuel elements must be as hot as the hydrogen gas which produces the thrust. Apparently a temperature of about 3,500 to 4,000 degrees Fahrenheit will be possible using materials developed in the Rover program. Exhaust gases from the best chemical rockets are in this temperature range, but the chemical engine has a tremendous advantage. Its walls can be cooled to relatively low temperatures with films of propellant and by various other means. The nuclear-fuel elements must be as hot as the gas they heat.

The fine performance of the nuclear rocket compared to the chemical rocket is therefore not a result of higher gas temperature. It is gained by using hydrogen propellant. Hydrogen's molecular weight is only about one-third the molecular weight of the exhaust gases generated by the combustion of the best combination of chemical propellants. Theoretically this means that at a given exhaust temperature one pound of hydrogen can produce three times as much thrust as one pound of the best chemical propellants. This thrust advantage can be translated into a greater payload-lifting capability. Or, if the payload is held constant, the nuclear rocket can propel it to much greater distances from the earth than the chemical rocket.

Proof that this type of nuclear rocket is feasible was gathered during the three Kiwi tests. Graphite-loaded uranium was found to be a satisfactory fuel element material. Adequate means were found to support these brittle plates against the high-pressure loads created by the flow of hydrogen through the reactor. The fundamental concepts were established for a flight-type control system for the nuclear rocket.

A series of Kiwi-B tests will be made later this year to evaluate engines which come closer to the designs needed for flight. The main objectives of these tests are to use a flight-type propellant feed system and a flight-test type of nozzle cooled by hydrogen.

A series of Rover engines will be required for three reasons. First, a restart capability will be needed for certain space missions. This probably can't be achieved with the first nuclear rocket. Second, it is anticipated that engine design can be improved significantly through flight experience. Third, engines of different thrust levels will be required.

Current plans call for the first nuclear rockets to produce several thousand megawatts of power. This translates into thrust at the rate of about fifty pounds per megawatt. Large reactors producing tens of thousands of megawatts, which could be used in single-stage rockets to boost very large payloads off the earth, undoubtedly will not be developed until small reactors have been flown successfully.

NASA is studying a method to get around the power limitation of the early nuclear rockets and to provide a means of varying the thrust produced by any reactor. Basically this method is to increase thrust by adding chemical power to the nuclear rocket system rather than by increasing reactor power.

The most efficient and practical way of doing this is to burn a mixture of liquid hydrogen and liquid oxygen in the hot steam of hydrogen leaving the reactor.

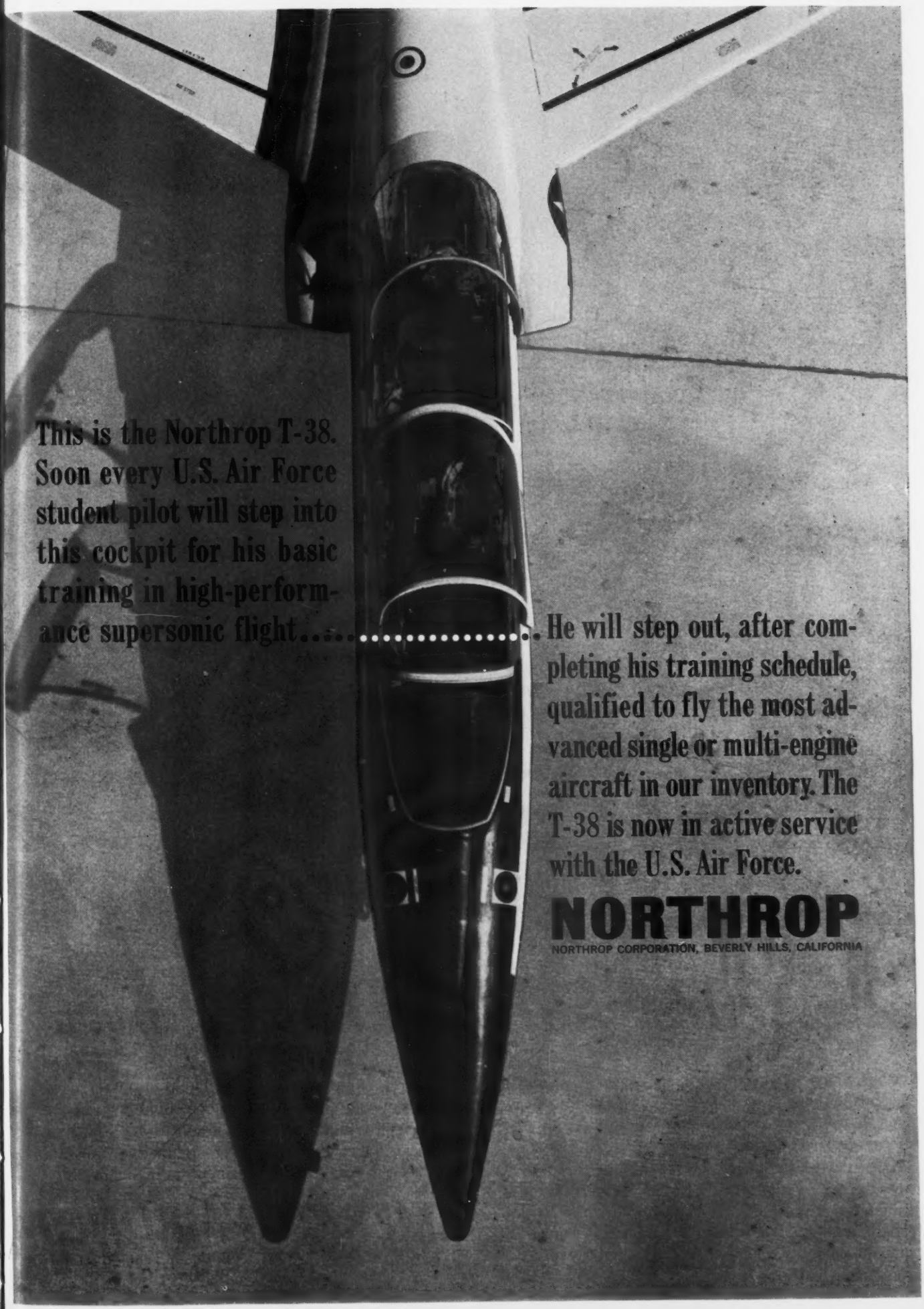
This is analogous to providing the nuclear rocket with an afterburner. It appears possible to increase thrust fifteen times or more by this method.

Two penalties must be paid for the thrust increase. One is a loss in specific impulse. However, since augmentation would be needed only over a relatively small portion of any trajectory, this loss probably would not lead to a major reduction in over-all mission performance. The other penalty is that either added nozzle area or a large increase in operating pressure is needed during augmentation. Reactor strength limitations probably would rule out raising the operating pressure. Two possible schemes for varying nozzle area are shown on pages 38 and 39.

The afterburner idea makes it possible to consider using nuclear rockets as boosters during the 1960s and firing them from launch pads on the ground. A great deal of study has gone into determining the relative safety of this type of launch *vs.* starting nuclear rockets in space after they have been put into safe orbit by chemical engines. Most Project Rover people apparently feel that ground launches would not create an uncontrollable hazard although there has been much comment outside of the project favoring orbital start.

Most important point in support of the ground launch is that the reactor is clean when it starts and has no radioactive fission products. In case it crashes to the ground before it reaches orbit, its total power production has been low, and its accumulation of fission products is much lower than that from the smallest weapons ever tested.

Heavy neutron and gamma-ray production as the rocket lifted off probably would make the launch stand and surrounding area within the radius of a mile "hot" for a few weeks. To overcome this problem and still have the use of vital and expensive range instrumentation, Texas tower launch stands probably will be built at sea down the Atlantic Missile Range beginning a few miles offshore from Cape Canaveral. During in-flight aborts, reactors probably will be destroyed by flushing out with flourine or other strong oxidizers and/or blown apart by explosives. All reactors, whether they had been started or not, would receive this treatment.—END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USAF's outgoing Director of Administrative Services examines the results of a determined AF-wide campaign of recent years to streamline Air Force administrative efficiency. The far-ranging effort covers everything from message and letter formats to the handling of classified material, the preparation of publications, and the keeping of records. It's all part of . . .

USAF'S PAPERWORK PIPELINE

Col. James L. Tarr, USAF (Ret.)
FORMER DIRECTOR OF ADMINISTRATIVE SERVICES, USAF

PAPER, paper, paper. Records, memoranda, letters, books, manuals, directives, messages. They make the modern world, including the Air Force world, go 'round. Gold may still be the sinew of war, but the modern-day paperwork pipeline is certainly the nervous system.

How well is this vital pipeline functioning? The best answer probably is, to borrow from the weathermen, "fair today, better tomorrow" as a result of a determined Air Force-wide campaign in recent years. This campaign has ranged far and wide—from writing to postal service, from printing to the handling of classified matter, from forms and procedures to the stocking of libraries to the composition of military dispatches. It has been felt from the Pentagon to rocket test sites to our far-flung overseas bases.

As USAF's Director of Administrative Services, I have been close to these developments. I believe we have achieved important progress in the direction of streamlining our efforts. The purpose of this article is to share this experience in an area of concern both to the service and industry, and to encourage further progress in the paperwork business.

Three years ago we embarked on a long-range project to improve written communication in the Air Force. We had an obvious need to reduce the vast number of electrical messages that our people were sending. Searching for the reason for so many messages, we were surprised to find that many of the people who sent them did so not because of an urgency for the addressee to receive them, but simply because messages were so much easier to write than letters. Obviously then, we had to make our letters as easy to write as messages. We have done this in several ways. First, we simplified the letter format, and standardized its use throughout the Air Force.

At that time, in addition to the traditional military

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letter, we wrote a different version to civilians and other government agencies. Within a headquarters office we used a still different method. We called them memorandums or Disposition Forms (DFs), and we used a printed form on colored paper.

Many old-timers thought we were radical when we announced that the new letter would be used for *all* written communications. With minor exceptions we now type military, civilian, or office communications the same way.

This new Air Force letter is now well established. With its printed captions, block style, and simplified address, it takes twenty percent less time to type than the old-style letter or memo. The average takes five minutes, so our saving is about one minute per letter. This may not seem like much. But remember that we write about 55,000,000 letters and memos a year. Assuming that an average typist puts in seven productive hours of work a day, allowing for week ends, holidays, sickness, and leave, you find that 55,000,000 minutes is equal to 579½ man-years.

Having to learn one style instead of three saves training time for new clerks and typists. Because the form is simple, there are fewer errors and thus fewer occasions to retype. More usable space is provided on the new form, and thus there are fewer continuations to a second or third page, which also reduces the bulk of our files. Use of a simplified address is also a major improvement.

We have turned prime attention to writing itself. Our goal is to train Air Force personnel to write better, faster, with fewer words, to shorten the typing time, and above all, to shorten reading time. We are well aware that it will take a long time. This is because high schools and colleges don't teach the kind of writing we must use. Instead, they teach creative and traditional writing when what we need is down-to-earth, practical, simple expression.

All of us were trained to consider military expression in terms of, "This headquarters considers your headquarters to be responsible. . . ." Now we are training the future Air Force to say, "You are responsible." It is up to us to start our new people right. As for our old-timers, we're encouraging them to change, but we know their habits are often too deep rooted in the traditional military writing rut.

Another important aspect of paperwork preparation is the development of forms. Forms are the mediums or tools for carrying out procedures, making reports, and creating records. A good form costs no more than a poor one. A poor form wastes the time of the people who must use it. This may be because of poor design, unnecessary entries, or useless records. A great deal of our paperwork burden all along the line is caused by unnecessary and poor forms.

We actually have a strong Forms Management Program in the Air Force, although it may not seem so, considering that we have more than 65,000 forms in use. This huge number results, basically, from misapplication of the theory that a subordinate commander should not be told *how* to accomplish his

(Continued on page 47)

Some 520,000 personnel records are in files at Reserve Records Center, with essentials on tape.

Streamlined

One good example of streamlined paperwork policies in action is the Air Reserve Records Center, Denver, one of the largest and most efficient personnel centers in the world.

In 1954, the first full year of its operation, the Center maintained the records of and administered to 240,000 Reservists. Today the figure is approximately 520,000. But even fewer personnel are required today in the processing and maintenance of the voluminous records file—containing over 7,000,000 documents—than were needed in 1954. This is no accident because, from the very beginning, every effort has been made to operate with the highest efficiency and the lowest cost.

As the Center's workload grew it became obvious that many times the present number of drawer-type file cabinets would be needed—and space simply was not available. This problem was solved when the cabinets were replaced with open-shelf files, saving 10,000 square feet of floor space and making it much easier and faster to locate a record and pull it or refile it in the proper place. File clerks had been moving tons of steel each year to reach the desired records, whereas in open-shelf filing the clerk has to move only the desired record groups.

At the same time, another change for the better was made. In the past, records had been filed in alphabetical order by last name, first name, middle initial, and, in some cases, last four digits of the service number. Eighty percent of these records were for individuals whose names began with one of thirteen letters.

Brig. Gen. J. M. Chappell, Commander of USAF Air Reserve Records Center.

Information is transferred simultaneously to paper tape and hard copy by data-processing machines. Taped information is later sent to computers.

Paperwork in Action at Denver Records Center

It was decided to use terminal-digit filing—a simple, fast, and accurate method of filing. The fundamental difference between this method and straight numerical filing is that the numbers—in this case, service numbers—are used in groups of two digits. They read from right to left, instead of from left to right. The greatest value of the terminal-digit method is in large, active files where there is skip numbering or where many of the older numbers have been removed. Since these two conditions are especially prevalent in service numbers, the files at the Air Reserve Records Center were ideal for conversion.

Any change, even a change for the better, can and usually does cause problems. The change to terminal-digit filing at the Air Reserve Records Center was no exception. Even today it is difficult to educate many Reservists always to include their *service number* as well as name, grade, and address, when writing to the Center.

The ever-increasing workload emphasized the need for greater speed and accuracy. Automation and electronics were the answer. An all-transistorized electronic computer and a high-speed paper tape input system now are the nucleus of the automated personnel records keeping.

Brig. Gen. J. M. Chappell, Commander, Air Reserve Records Center, has this to say about automation: "In our continuing search for more efficient and more economical ways to handle additional work, we installed an electronic data-processing system which now assumes greater speed and accuracy for many of the ARRC operations and enables us to provide better service. We are proud of the development of our electronic data-processing system and of the way it is improving the quality of our work. We are confident that the program will be a credit to the Air Force and to the government."

The system achieves highest operating efficiency and best use of manpower through central and automatic control. To start a work routine, an operator at the control panel pushes a combination of buttons and switches, activating the work program. From then on, the operation is under program control, and the system automatically performs the entire task without human intervention. Yet, if desired, the operator may manually control the operation and may read out every step of the execution of a program.

A master file listing each of over a half million Reservists is maintained on magnetic tape. A single officer record will average 187 digits of information on a piece of tape three-quarters of an inch wide and one inch long. The average airman record is slightly smaller. This file is frequently updated and is the basis for all other operations.

The computer performs all necessary actions to support selection boards, such as providing them with rosters and the necessary controls. But many factors involved in making promotion selections still require human judgment.

The ARRC's job is a big one. It is being pursued energetically with the help of modern efforts and methods in the vast world of paperwork.—The Editors

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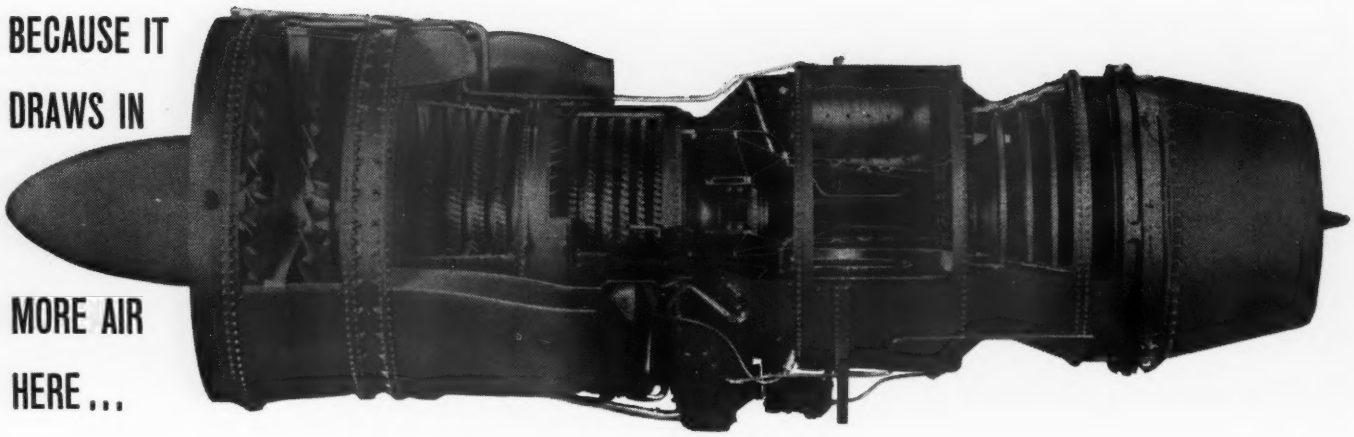
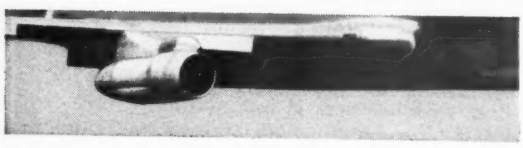


THE PRATT & WHITNEY AIRCRAFT TF33 TURBOFAN GENERATES UP TO 42% GREATER THRUST



In simplest terms, this is how the Pratt & Whitney Aircraft TF33 (JT3D) turbofan has improved on the efficiency of the conventional turbojet engine. The TF33 is the logical extension of the turbojet's design simplicity, flexibility and unprecedented reliability, proved in over 12,000,000 hours of flight. The TF33's increased thrust—42% greater on take-off than its straight jet counterpart—permits use of shorter runways, gives quicker climb to cruise altitudes, and faster cruise speeds. Substantially reduced fuel consumption greatly extends range. Eight TF33 engines power the huge Boeing B-52H. They develop 136,000 pounds total thrust, 40,000 pounds more than the B-52G's turbojets—more power than any plane in the free world.

Pratt & Whitney Aircraft
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mission. This theory is good for combat operations; but when applied to command-wide administrative practices it forces each unit to stop and develop its own procedures and forms. It is one of our worst paperwork evils.

Preparation of our publications involves a huge portion of our budget and our time. We don't know how much it costs us to prepare our publications. Practically all those concerned with the operation and maintenance of our aircraft, missiles, and, for that matter, all our equipment, must be developed and written by the equipment contractors. This represents a meaningful portion of the equipment cost.

We have too many publications in the Air Force. Too many are poorly written, verbose, repetitive, and badly organized. We have more publications than our people have time to read, both numberswise and lengthwise. Three factors contribute to this excessiveness. First, the average person writes poorly and laboriously. Second, the rapidity of new developments and changes brings new equipment and systems into use more rapidly than the old can be phased out. Third, our complex organization, and our very necessary policy of decentralized responsibilities place great pressure on bright and enthusiastic young men to move quickly. So the new publications pour in before the old ones can be digested.

To improve the first factor, poor writing, continuing emphasis on effective writing will be needed. As a basis for this effort we have developed a new manual, AFM-10-4, "Guide for Air Force Writing." It is tailored to the Air Force writing problems, and is to be the one and only textbook and reference for all instruction and training that is given on the subject.

As for the second and third factors, there are no real solutions. But we can improve. We can be more prompt to eliminate those publications that are out of date. We can be more cautious to ensure new ones are needed before they are published.

Reproduction is another massive area of what we are calling paperwork. Our annual printing budget in fiscal year 1959 was $38.7 million, all of which was expended with the Government Printing Office, commercial printers, our nine industrial-funded printing plants, or for printed material. Additionally, the operation of our twenty-plus nonindustrial-funded printing plants, and hundreds of duplicating centers, some larger than our small printing plants, plus thousands of office duplicating devices, add very considerably to the total cost of reproduction. Office fast-copying devices have brought about a small revolution in this area. The Air Force uses thousands of them. Although they more than pay their way, it will startle some to know that last year we spent $200,000 for facsimile paper alone at Hq. USAF.

Reproduction has advanced a long way in the last few years. Things which formerly could be done only by experts in large printing plants can now be done by persons with relatively little training on office duplicating devices. New ideas, new and better equipment, are constantly reaching the market or are being developed.

One of our recent improvements has been to standardize the management of all of our printing plants. Previously, each plant had its own system. Although our nine industrial-funded plants were operated in a similar way, those that were not funded had no standardized procedures.

The supplement system for field publications is the best idea to be developed in the area of publications management since the Air Force achieved independence. Under it, subordinate commands add their own supplements to regulations from higher authority. This eliminates duplication and facilitates compliance with regulations further along the line.

Distribution, the mission of which is to get written communications into the hands of those who must have them, is another area that has always merited our best efforts.

Much has been done to improve our postal service in the past several years. It is now a primary means for transporting small parcels containing high-priority supply items. These are often for aircraft, radar, or missiles which are nonoperational for lack of that item. The average airmail cost for small parcels is about the same as for air freight; but mail requires no paperwork while a freight shipment requires a bill of lading, and air freight also requires an air movement designation. Sometimes the paperwork for these represents a greater cost, in man-hours, than the transportation cost.

The simplified address system mentioned earlier also has helped us improve our distribution system. By having one standard way of marking, abbreviating, and indicating the action offices, the routing clerks and postal and transportation people can recognize the correct destination immediately. The number of misshipments has been greatly reduced.

We have made other important improvements. Operation Straight Shot was a project to provide direct routing of high-priority publications and supplies from the AMC Air Materiel Areas and Depots to the aerial ports. Formerly every thing had to go first to Postal Concentration Centers at large seaports, *i.e.*, New York, New Orleans, San Francisco, and Seattle. Upon arrival there they had to be sorted and rerouted to the aerial ports (Dover, Del.; Charleston, S. C.; Travis AFB, Calif., and McChord AFB, Wash.). This delayed all of the mail from one to several days. Although the idea is not used much now that we have shifted to commercial carriers, we proved it feasible, and it will be used whenever demanded by emergencies.

One of our important procedural improvements has been in the field of classified material. Formerly, each command was obliged to develop its own procedures and forms for receipting, routing, and controlling classified documents. By developing a simple, standard system for use all over the Air Force, we spare the commands the additional time it takes them to develop their own systems and forms; we eliminate the need for retraining each time individuals are transferred; we decrease the chances for loss or compromise of a classified document; and we make savings in forms management and procurement. We are also exploring

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new and more efficient methods of classified material destruction.

By disposition in the paperwork business we mean storage, retirement, destruction, and preservation. The first step in the storage process is filing.

At the present, the Air Force has in its current office files about 1,240,000 cubic feet of papers. This is some 71,000 cubic feet less than was on hand a year ago, the result of a determined cut. We have about 347,000 cubic feet in our semipermanent-file staging areas. The National Archives and Records Service, General Services Administration, now operates the principal records centers at which Air Force records of permanent value are retired. The largest of these, the St. Louis Record Center, was transferred to GSA as of June 30, 1960. At St. Louis, there are over 170,000 cubic feet of our records. Most of these represent the histories of those individuals who have been separated from the Air Force since 1947. Some 123,000 cubic feet of organizational records are in other GSA Centers, including the National Archives. Over 15,000 cubic feet of weather records are held by the Department of Commerce.

Since 1945, when we first established a records management program, the Air Force has created about 8,100,000 cubic feet of records. Through our record destruction program, almost 6,200,000 cubic feet have been destroyed. Our current files are housed in 220,000 file cabinets (each holding six cubic feet of records).

Poor filing practices contribute immensely to our paperwork problem. First of all, the average person makes too many copies each time he prepares a communication. Behind most of this is the "alibi" file—the feeling that one must keep copies to protect himself, or "just in case." Basically, all of us have an inward fear of being blamed unjustly. Then too, there is the opposite tendency of pride in our work. We do something good and we want everyone to know it, so we make many copies and send them around. Then, there is the often abused theory that everyone must have a copy of everything, in order to keep informed. All these contribute to our records problem. All of them add innumerable clerical personnel to our overhead.

Ways and means must be found to reduce further our permanent files. We have long hoped that microfilming would be the answer, but experience has shown us that it is usually senseless and wasteful to microfilm records unless we can destroy them afterwards. Also, it is not yet practical to microfilm records after they have been placed in storage since it is a slow, labor-consuming process. The proper time to microfilm is when the record is created. However, several developments are under way that offer some hope of a solution to the problem of what to do with papers already in our files.

One of our command directors said recently: "When an administrator feels that he has achieved the ultimate, he is out of touch, lost contact with reality, or simply hasn't formally been pronounced dead." What does the future hold for the paperwork business? First, we can be certain that before many years an individual will have to be able to write effectively before he will be acceptable to positions of high responsibility.

Secondly, we will see great strides in automated administration. For example, devices already exist that can scan a typewritten page and convert it to punch cards, microfilm, or punched, magnetic, or videotape. The information can then be automatically transmitted electrically over existing communications systems. Upon receipt, it can be reconverted to its original form. Let us envision that all of our written communications are prepared and transmitted in this manner and the original processing media, tape, or microfilm, becomes our record copy. The typewritten original is used temporarily, then destroyed. When we wish to see a paper, we dial predetermined codes, and our paper is automatically thrown before us on a viewer screen or television. Copies are had by pressing a button. Material which we don't need to retain in these microfiles is erased by an automatic process.

To go further with these ideas, we can conceive of high-speed printers that will accept our regulations and manuals and reproduce them in the quantities needed at each headquarters; or better still, simply store them on videotape for presentation as needed. Such a seemingly impossible thing as the automatic translation of Russian to English has already been accomplished. Many different ideas for microfiling and retrieving are in various stages of development.

Another important development will permit a stenographer to take dictation on a stenotype machine which feeds into a transcriber that will automatically convert her notes into final copy. Another one will transpose an individual's dictation into final typewritten copy. These are not just pipe dreams. The equipment to do all these things is close to reality.

I will close with a practical thought in the form of a story about one of our directors who was playing golf. After a poor drive, he found his ball out in the rough, on a large ant hill. He took a mighty swing but hit beneath the ball, damaging the ant hill considerably. He took another swing, this time really clobbering the ant hill, but not moving the ball a bit. At that point, one remaining ant said to another, "Buddy, if we want to survive we'd better get *on* the *ball*."

Administrative efficiency, dependent to a substantial extent on the paperwork pipeline, is essential to the national strength we need for survival through these days and years of grim international challenge.—END

During the four years before his retirement on April 30, Colonel Tarr had been responsible for USAF-wide supervision of all administrative services, including procedures, written communications, publications, orders, printing, records management, forms management, and postal and courier services. Earlier he had served as Adjutant General of Fourth Air Force, at Far East Air Forces in Tokyo, and at Air Materiel Command. Colonel Tarr entered Army service in the 1930s. During World War II he served in England, North Africa, and Italy. Later he was Adjutant General of the Sixth Army Group in France and Germany and was the Ground Adjutant General before he transferred to the Air Force in 1948.

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YESTERDAY'S 'FIRST LINE OF DEFENSE'

Murray Green

The following article—first of two by Dr. Green on the history of the struggle for a unified defense establishment—represents the author's own thoughts and conclusions and should not be construed as necessarily reporting official policy of the Department of Defense or the US Air Force.

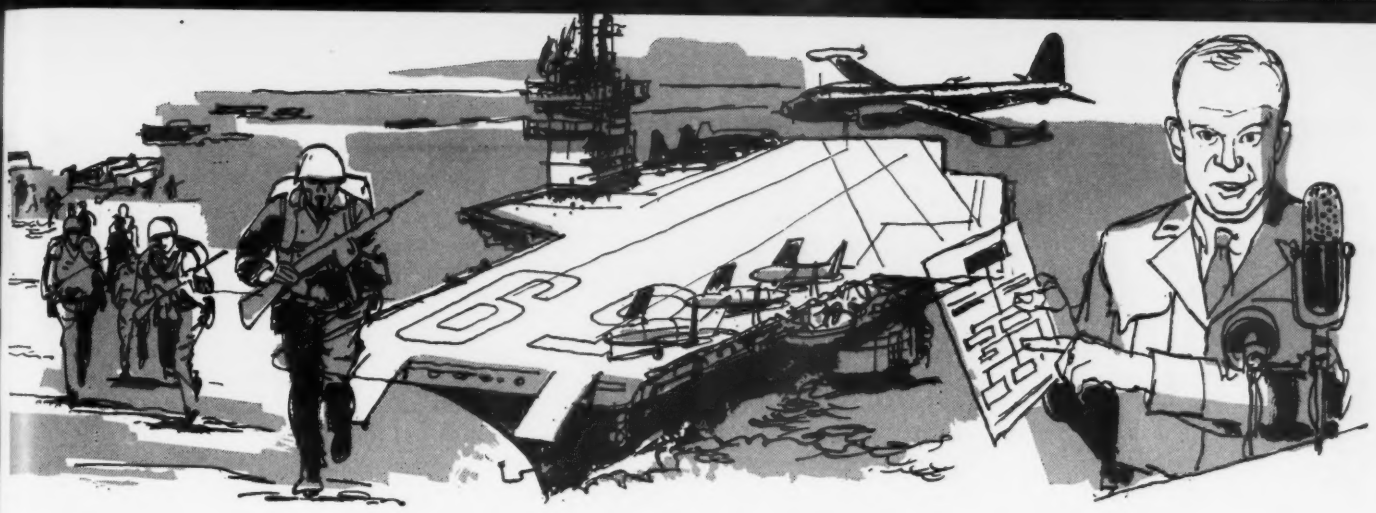
IN 1898 the Army's Commissary General wrote that his office was running perfectly until the war with Spain disrupted and disorganized it. Five years later, a frail craft took wing at Kitty Hawk and in the process launched a new idea of warfare. Over the span of one generation, this idea disrupted and disorganized the carefully laid functional separation between the Army, pillar of national defense on land, and the Navy, "the nation's first line of defense" at sea.

By the end of that generation, Americans had stopped calling the Navy "the nation's first line of defense." A Gallup Poll, published in October 1949 at the conclusion of the B-36 hearings which aired in minute detail every nuance of our national policy, disclosed that seventy-four percent of those polled believed the Air Force "would play the most important part in winning . . . another World War." Six percent chose the Army; only four percent chose the Navy.

This revolution in public response, inevitably reflected in congressional appropriations, is central to our understanding of the bitterly determined, seemingly eternal opposition of the Navy to unification of the armed services. That record is unmistakable: *vs.* the original unification proposals; *vs.* the strengthening amendments of 1949; *vs.* the Eisenhower Reorganization Act of 1958; *vs.* the Symington Committee recommendations to President-elect Kennedy in 1960; and most recently, *vs.* the Defense Department directive assigning the USAF single managership of space development projects.

Pride in past glories helps *esprit de corps,* but may overstay its usefulness when it exercises a pervasive influence upon a military organization's response to the necessities imposed by changing technology. The origin and development of the Navy's psychological orientation, from the dawn of the air age to the dawn of the space age, are readily discernible. They shed light on the reorganization issue as it stands at the moment.

From the turn of the twentieth century to the eve of World War II, with the exception of a brief interlude during World War I, the Navy has dominated US defense budgets and, to a lesser extent, the nation's defense thinking. In *Why England Slept,* which he wrote in 1940, young John F. Kennedy reported some interesting statistics for the midway years between the wars:



US Defense Expenditures

	1926-27	%	1927-28	%	1928-29	%	1929-30	%	1930-31	%
Army	$267.3	45%	$293.2	47%	$312.1	46%	$327.3	47%	$345.2	48%
Navy	324.2	55%	332.2	53%	366.1	54%	375.4	53%	382.5	52%
TOTALS	$591.5		$625.4		$678.2		$702.7		$727.7	

The figures themselves do not wholly reflect true proportions; the Army appropriation included funds for nonmilitary functions such as care of cemeteries, certain Corps of Engineers functions, activities, and much else. Perhaps the ratio of real defense appropriations was more like sixty to forty percent.

Beyond the military necessities, the apportionment of defense monies was influenced by other matters. Traditionally, in a democracy such as ours—and Britain's, too—armies have reminded people of Napoleon, the "Prussian General Staff," or some hybrid nightmare. The American image has portrayed armies as fatally lacking in glamor. In American historical mythology, it has always seemed easier to stir the imaginations of Americans with tales of heroism at sea. The careers of John Paul Jones and Stephen Decatur held a fascination which those of generals—no matter how solid their virtues—were unable to equal.

But during World War I, and afterwards, Billy Mitchell, Eddie Rickenbacker, Charles Lindbergh, and a host of other men who braved the "wild blue yonder," began to chip away at this psychological pillar of esteem.

In the '20s this slowly changing attitude was no threat to the Navy's preeminence. As one historian wrote of that period, the airplane was identified with aero clubs and county fairs. It "met the same good-natured skepticism and witticisms as had greeted the steam locomotive and the horseless carriage. Nobody was afraid of it."

By the '30s, there was a definite change. The military airplane began to develop its potential in terms of range, stability, safety, and payload. There was this indication of the shape of things to come.

In August 1930, Secretary of War Patrick J. Hurley wrote to President Hoover deploring what he called the Navy's intrusion into the Army's coastal defense mission and the development of naval land-based aviation despite a congressional injunction. The Act of June 5, 1920, had assigned land-based bombardment aircraft to the Army and fleet air operations to the Navy.

The dispute was promptly settled within the military family. Gen. Douglas MacArthur, Army Chief of Staff, and Adm. William V. Pratt, Chief of Naval Operations, signed an agreement under which each service's air arm was to be "free to develop within well defined limits"—that is, the Army dominant over land while the Navy would preside over water.

But the airplane was no respecter of pat agreements. In May 1938, for example, three B-17 crews on a GHQ Air Force exercise spotted and "buzzed" the Italian liner *Rex* 725 miles out of New York harbor. The Navy exploded at this incursion into its "paramount interest." Within the week, the CNO had extracted from an almost equally irate Army Chief of Staff a verbal agreement to forbid the upstart Air Corps from operating beyond 100 miles offshore.

This restraint broke down short years later under the pressures of World War II. The spectacular successes of the Luftwaffe over Poland, Norway, and Western Europe brought new understanding of airpower. In May 1940, President Roosevelt called for 50,000 planes. In 1941-42, the Army Air Forces gained a measure of autonomy within the War Department.

But US military doctrine failed to keep pace with technology. Doctrine, by definition, embraces concepts of organization and strategy by which technology can be effectively applied in national defense. Doctrine is the military man's gospel. In the United States, as we prepared to enter hostilities, Army and Navy leaders were unable to reconcile their special interests in a common doctrine to keep pace with fast-striding technology.

Six weeks before Pearl Harbor was attacked, Secretary of War Henry L. Stimson sought to avoid giving offense to the Navy on the touchy issue of "paramount interest" in the matter of locating Nazi U-boat packs lurking in the Atlantic waiting for allied convoys. A War Department directive of October 24, 1941, read in part: "To avoid any infringement upon naval functions, commanders concerned will refrain from referring to their tactical reconnaissance as offshore patrols." Reconnaissance "over the sea" was redefined as a naval defense task. Henceforth, AAF planes were to fly "inshore" patrols. There was a certain ambiguity about the directive. It left unclear whether the *status quo* existed, but under a different name, or whether AAF planes were actually debarred from offshore reconnaissance.

If reconnaissance by any other name had a bit of comic opera about it off Staten Island, it was rather more serious in the Philippine Islands where, that very same week, the Commander in Chief of the US Asiatic Fleet exchanged views with the Commander of US Army Forces in the Far East. Adm. Thomas C. Hart proposed to General MacArthur that the Navy "control all scouting, patrol, and reconnaissance operations over the water." In exchange, "the Navy is prepared to place under Army's full tactical com-

(Continued on following page)

mand such of its aircraft as may be assigned for attack on land objectives in the Philippines."

"I find the proposal entirely objectionable," MacArthur replied. "The mission of the US Asiatic Fleet at the present time, insofar as its strategic employment, is not known to me, nor have I been informed as to what you may have in contemplation," his November 7 letter stated. Under extraordinary conditions, MacArthur noted, elements of the AAF, "the most powerful offensive striking element available in the Philippine Islands," might advantageously operate under temporary naval direction, but in this sense—and here MacArthur must have withered Hart—"the term 'Fleet' cannot be applied to the two cruisers and the division of [usually four] destroyers that comprise the surface elements of your command."

Such was the state of interservice cooperation just one month before Pearl Harbor. And at that defense bastion, relations were not much better between Admiral Kimmel and General Short, as a congressional investigation subsequently disclosed.

Twenty years later, the experiences of World War II notwithstanding, there remains a curious but strong undercurrent of opposition to the establishment by Secretary of Defense Thomas S. Gates of a Joint Strategic Targets List in August 1960 as part of a Single Integrated Operational Plan to be invoked in the event of a major war.

The exigencies of World War II did dictate substantial cooperation, although by 1942 it became necessary to establish the Joint Chiefs of Staff to reconcile differences. Cooperation existed to the degree that both sides, and sometimes three sides—when the AAF asserted its independence from the parent War Department—made voluntary concessions. In mid-1942, for example, Adm. Ernest J. King, Commander in Chief, US Fleet, tried to obtain two- and four-engined bombers to be manned by Navy crews for antisubmarine duty in the Atlantic. General Arnold turned him down because there were not yet enough of these bombers to satisfy his own requirement. Gen. George C. Marshall stood discreetly on the sidelines while some hot memoranda were exchanged.

In the Pacific, the Army and Navy were having their troubles. The Marines landed on Guadalcanal in August 1942. The Army, at the same time, was hard pressed to keep the Japanese from overrunning New Guinea. Espiritu Santo in the New Hebrides became famous as a principal South Pacific logistics base for both services. Without adequate central control, supply lines became fouled up. Army Maj. Gen. LeRoy Lutes, a supply expert, was sent out to help straighten them out. His report to the Commanding General, Services of Supply, of November 12, 1942, is—even allowing for a certain amount of bias in favor of his own service—a minor classic.

It seems that Army and Navy airstrips were constructed less than five miles apart on Espiritu Santo. Separate tractors and engineering materials were used by the Aviation Engineers and Navy Seabees throughout, with separate access roads being constructed. General Lutes reported that Navy officials told him their airfield project was of such priority that no construction equipment could be loaned to the Army.

At another resupply base, in Noumea, New Caledonia, seventy-five ships congested the harbor with Army and Navy supplies. Only five berths were available to unload the ships. Dispute waxed hot over which ships should unload first. No study of the importance of each Army and Navy cargo was made, no priorities assigned. The competition reached such a state that Admiral Halsey, who also chafed at the bickering, voluntarily moved his supply staff ashore alongside the Army's where decision-making then proceeded in an atmosphere of informal cooperation. Halsey did not inform Admiral King in Washington because he feared the informal agreement would be canceled.

In Hawaii, Admiral Nimitz "agreed with me," Lutes wrote, "that there was need for joint logistics staff work." But Nimitz could not act without approval from Washington, "and it was more than six months before he received authority to organize within his staff in Hawaii a joint logistics group," Lutes reported. Then there were the separate Army and Navy station hospitals. Lutes did not attach sole blame for this situation to either service.

In 1944 , the JCS, partly in response to criticisms by the Senate "Watchdog" Committee headed by Sen. Harry S. Truman, sent its own special committee to the war theaters to elicit experienced opinions on the subject of joint service activities. Among those interviewed, Admiral Nimitz strongly supported a postwar military unification. Admiral Halsey, in typical candor, said: "I probably am one of the lone naval officers in favor of a single department. In other words, I believe in unity."

But what about the danger of giving too much authority to the single head of the armed forces, he was asked? "I am not afraid of that," he replied.

And what about the political power that a single Secretary of Defense would wield, a questioner persisted? "He'd probably have a lot, and he should have," Halsey replied. "Again I am not afraid of it, if it gets results."

Halsey hoped this unification would come about six months after the war ended. But, would service people accept it, the Committee asked? "I think that if they can't, they ought to be made to do it—have it beaten into their heads."

Back in Washington, Admiral King was less convinced of the desirability or the inevitability of merger. In 1945, some years before Defense Secretary Charles E. Wilson evoked national cries of anguish for expressing a parallel thought, Admiral King told the Senate Military Affairs Committee: ". . . If the Navy's welfare is one of the prerequisites to the nation's welfare—and I sincerely believe that to be the case—any step that is not good for the Navy is not good for the nation."

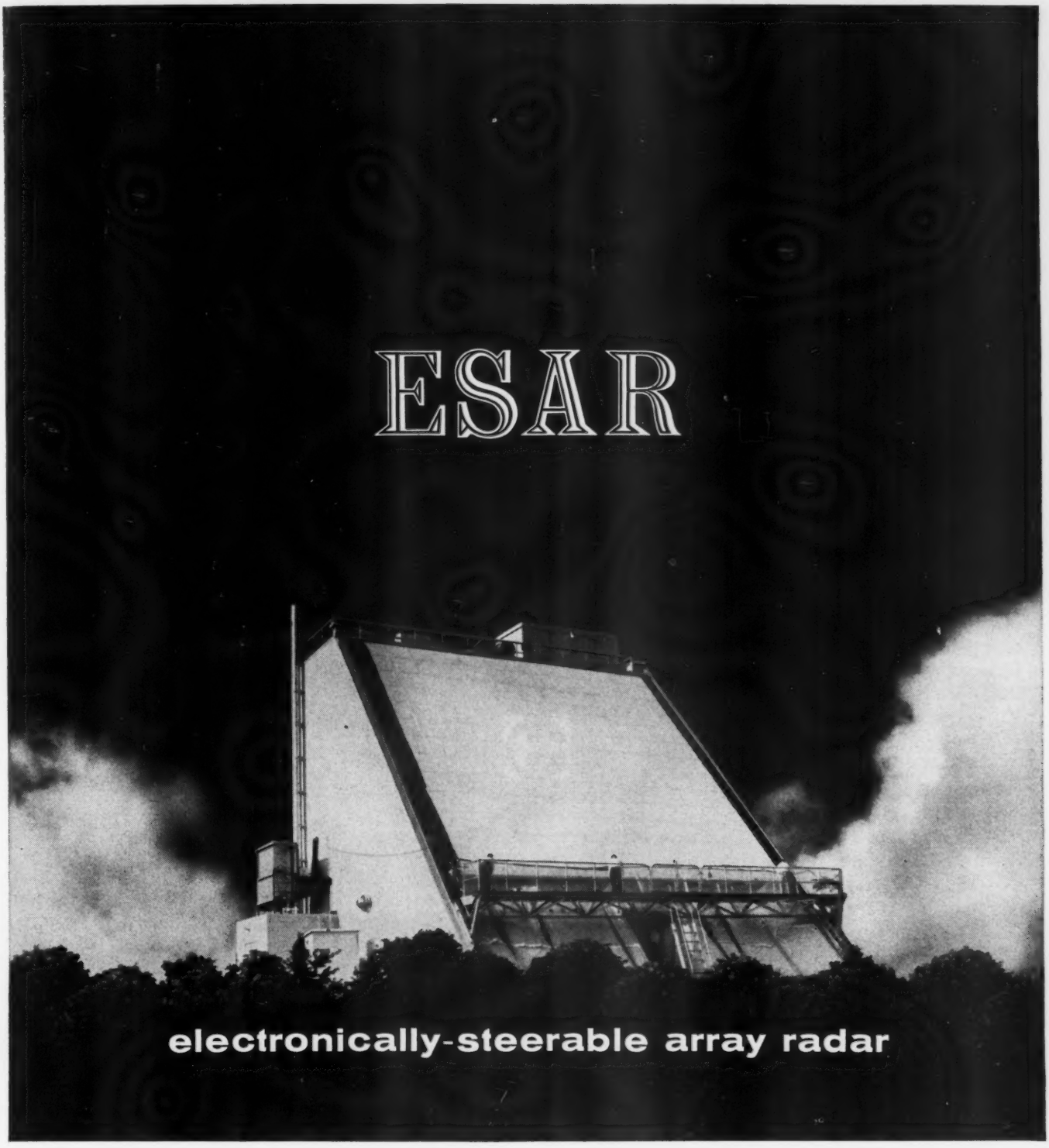
Upon reflection, one cannot strictly assume that Admiral King had ruled out unification under any conceivable circumstances. A memorandum deposited with James Forrestal on July 1, 1948, stated that King had at the end of the war urged General Arnold: "Hap, bring over your strategic bombers, and we will shut out the War Department." Inasmuch as General Arnold never volunteered to do so, Admiral King was willing to settle for the *status quo*. In his final report to the Secretary of the Navy, Admiral King proposed to maintain the voluntary wartime cooperation:

"It was fortunate that the War Department and Navy Department working together for many years—definitely since World War I—before the war began, had correctly diagnosed what was likely to occur and had instituted, not rigid rules, but a set of principles for a joint action in the field, which proved sufficiently flexible to meet the varied conditions that were encountered during the war."

As we have already noted, if such a set of principles existed, it was unknown to Admirals Hart and Kimmel as well as to Generals MacArthur and Short. These officers held the command posts under the enemy's gun and should certainly have been apprised of any plans for joint action.

Secretary of War Robert P. Patterson was also unaware of any joint plans. In his postwar reflections (New York *Times Magazine*) he blamed Pearl Harbor upon divided

(Continued on page 55)



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Army-Navy command. Some improvements occurred during the war, he conceded, but the requirements for unanimous JCS decision "caused many delays." The prime case, he said, was the inability of the JCS to agree on one commander to lead the final assault on Japan. In those last months, three separate commands commingled on Okinawa—General MacArthur's, Admiral Nimitz's, and General Arnold's Strategic Air Force. It was "fortunate," Patterson wrote, that we dropped the atomic bomb and the Japanese sued for peace before this conglomerate command structure could be put to a test.

John J. McCloy, Assistant Secretary of War throughout the war, expressed a near-subversive thought in 1948. He suggested to a "task force" inquiring into the need to reform the defense establishment, that we had overwhelmed our enemies by sheer numbers:

"Though the last war was handsomely won, victory was accomplished as much by the plenitude of our resources and energies as by good management. Those who know something of the inner conduct of the war are aware of the frustrations and compromises which marked some of its planning. . . ."

Navy Secretary James Forrestal, no ardent advocate of unification, saw some portents. In September 1944, while the JCS Committee was asking questions out in the field, the Navy Secretary was writing his friend, Palmer Hoyt, publisher of the Denver *Post*, that the Navy had lost its case for maintaining its separate postwar status. Forrestal said he advised King and Nimitz that "a merely negative attitude would not be enough."

In April 1945, Franklin Delano Roosevelt, ardent collector of ship models and Assistant Secretary of the Navy from 1913 to 1920, was succeeded by Harry S. Truman, former commander of a certain Battery "D," and former Chairman of the Senate "Watchdog" Committee. Two months later, the new President rejected a request by Forrestal to increase the peacetime strength of the Navy and Marine Corps on the grounds that "the time had come to put an end to piecemeal legislation and separate planning for the services."

Forrestal took the hint and enlisted Ferdinand Eberstadt, a close friend and business associate, to make a study. Eberstadt's proposal in September 1945 provided an alternative to the kind of legislation desired by Army and Air Force leaders. It called for three departments—War, Navy, and Air—each with its own air component. An extension of this logic, Stuart Symington pointed out to Secretary Forrestal a year later, should have permitted the Army to add its own Navy, and the Air Force to add its own Army and Navy, making for nine services.

President Truman believed there should be one Department of Defense with three branches. Navy supporters tried to head him off. In November 1945, a delegation led by Secretary Forrestal brought Sen. David Walsh and Rep. Carl Vinson, Chairmen of the Senate and House Naval Affairs Committeee, respectively, to the White House. Mr. Vinson told Mr. Truman bluntly that unification "would not pass either this winter, next winter, or the winter after."

The Chief Executive, a rather determined man himself, sent his message to Congress anyway. In December 1945 he called for a Department of National Defense with three coequal branches. It was the first time a President had ever publicly supported the formation of a separate Air Force.

In January 1946, unification was going to need superior political generalship to coax or push it through the Congress. There was mounting opposition by influential committee chairmen sympathetic to the Navy's desire to leave well enough alone. President Truman appointed Stuart Symington to be Assistant Secretary of War for Air. His principal assigned mission was to shepherd that legislation through both Houses. As Chairman of the Surplus Property Board, Symington had displayed valuable talents along this line.

Before Symington really came into the picture, however, Navy Secretary Forrestal had visited President Truman in March 1946 and urged him to put an end to "propaganda and lobbying" by the services. He suggested the issues could be hammered out at a top-level conference "by the fewer people . . . the better."

Early in April 1946, General Eisenhower, then Army Chief of Staff, arranged a private luncheon attended only by General Spaatz, Commanding the AAF; Adm. William Leahy, representing the President; and Admiral Nimitz, the new CNO. Eisenhower started the discussion by saying that any unification should be based on the premise that land-based air was a function of the AAF. Nimitz argued that land-based reconnaissance and antisubmarine warfare were vital to the Navy's mission. Eisenhower said he was opposed to assigning large numbers of land-based planes to the Navy.

The conferees also deadlocked on basic terminology. Eisenhower regarded Nimitz's language as "loose and confusing." The CNO had spoken of land, sea, and air forces throughout, using the word "functions" in the same sense the Army used "combat objectives." For example, Nimitz said "the function of the ground forces is to deal with land objectives." Eisenhower argued that the function of ground forces was to conduct operations on land. Dealing with land objectives, he said, was a function of air, land, and sea forces collaborating under a unified command established by the Joint Chiefs of Staff. General Spaatz strongly supported Eisenhower. Admiral Leahy tried to mediate the differences.

One week later, the Administration-supported bill was introduced by Senators Thomas, Austin, and Hill. S.2044 called for a Department of Common Defense comprising three separate and equal components—the Army, Navy, and Air Force. The administrative head would be the Secretary of Common Defense, a civilian and a regular member of the President's cabinet. There was further provision for a Chief of Staff for Common Defense to act as a military adviser to both the President and the Secretary of Common Defense. He would rank all other officers and would be appointed by the President with the concurrence of the Senate for a three-year term.

The next day, April 11, 1946, President Truman held a press conference and made some veiled criticisms of service "lobbying" against the Administration's bill. In reporting it, the press indicated that the Chief Executive had directed his remarks to the "Navy lobby." Secretary Forrestal was puzzled by this reaction, according to Walter Millis and Rear Adm. Eugene S. Duffield, compilers of his famous *Diaries*. He thought the Navy was the least guilty of the parties. If Forrestal were President, he told his *Diaries*, "I would in a week or ten days tell both services it was time to call a halt in the propaganda discussion and lobbying." Forrestal said he told Truman "the Navy would make it stick, but I didn't think the Army could, particularly the Air Forces." Forrestal recalled Truman telling him "that the Air Forces had no discipline."

The Air Force's discipline was, it must be agreed, not nearly so effective as the Navy's. Chairman Walsh had received a copy of S.2044 as a "courtesy" gesture. He decided to hold full hearings of his Naval Affairs Committee and called up a solid phalanx of Navy witnesses. One after

(Continued on following page)

the other, they denounced the bill as an open violation of the principles of democratic process, of improper coordination of foreign and military policies. Adm. Richmond Kelly Turner, one of the witnesses, offered somewhat more down-to-earth arguments:

"Frankly, I believe that the Navy as a whole objects to the so-called unification because under any system the Navy will be in a numerical minority and the Army and Air Force, a military majority . . . [who] will always be in a better political position than the Navy. . . .

"Because the Navy has had and should retain in the future its position as the first line of military security for the United States, I believe the Navy will never willingly agree to a consolidation of national military forces in any matter that will silence the Navy's voice in military affairs or materially restrict its present responsibilities."

Secretary Forrestal did not openly oppose the legislation. He told the Committee that he was "solidly behind *the basic objective of* the President" (*italics supplied*). Forrestal called S.2044 "illogical administratively" and said it would create "vacuums of authority."

Only two witnesses favorable to the bill were called to testify. Senators Thomas and Austin, whose names were on the bill, were asked only to explain its provisions. With their testimony, the Naval Affairs Committee suspended further hearings on May 9, 1946.

President Truman was irked by these dilatory tactics. He called a meeting at the White House and announced his decision to oppose a single Chief of Staff—a change from his previous position. On the other issues, however, he told the adversaries to work out points of specific agreement and disagreement and to submit both lists to the White House by May 31.

If Forrestal and Nimitz came away with some misgivings about continuing to drag their heels, their determination was given a boost by a private letter to them signed by Senator Walsh and Representative Vinson. This letter, under date of May 15, 1946, expressed the joint conviction that Congress would not create any single Department of Common Defense, transfer any aviation functions away from the Navy to the AAF or to a separate Air Force, or reduce the powers of the Secretaries of War and Navy.

One national news magazine called the congressmen "the entrenched chairmen . . . fearful of losing power of patronage," and predicted that if unification were to be achieved, "public and military pressure would have to reduce these last political pillboxes."

With that letter in his pocket, however, Forrestal joined Mr. Eberstadt at a horse-trading session with Patterson and Symington the next day. Forrestal told Symington he could either oppose a new department or perhaps decide it was none of the Navy's business what the Army did with its Air Force. Eberstadt stated the Navy's terms: Suppose the Navy were to agree to accept legislation creating the separate Air Force, would Patterson and Symington be willing to go along with the Navy's conception of limited powers for the Secretary of Defense? He received no commitment at that time, but as we now reflect upon the nature of the National Security Act of 1947, this is how the law turned out. The compilers of Forrestal's *Diaries* said the bill "had been shaped slowly, skillfully, and patiently, very largely in accordance with Forrestal's ideas."

Secretaries Patterson and Forrestal composed a joint letter to President Truman on May 31, 1946, as directed, but aside from agreement on a separate Department of the Air, there was little other agreement about control of aviation, limitations on expansion of the Marine Corps, powers to be held by a Secretary of National Defense, and the Navy's desire to retain full departmental status with cabinet rank for its secretary.

President Truman called a June 4 secret meeting at the White House to include all his top military and civilian leaders. The substance of the discussion leaked to the press, which commented upon the apparently irreconcilable service differences.

In exasperation, President Truman on June 15, 1946, released a letter to the service secretaries and appropriate congressional leaders outlining a twelve-point "unification" law. His letter, in sum, called for:

1. A single Department of National Defense under a civilian head who would be a member of the President's cabinet;
2. Three coordinate services—Army, Navy, and Air Force;
3. The Air Force to be responsible for all military air resources of the United States with the exception of shipborne and water-based aircraft essential to the Navy for internal administration, air transport, and training purposes;
4. The preservation of the Marine Corps as a separate entity with all its prerogatives;
5. Council of National Defense (National Security Council) with a chairman of cabinet rank;
6. A National Security Resources Board responsible for mobilizing the economic resources of the nation;
7. The Joint Chiefs of Staff set up on a formal basis to be responsible for strategic plans, integrating military programs, etc.;
8. Rejection of the single military Chief of Staff concept;
9. A Central Intelligence Agency;
10. A centralized agency for procurement and supply;
11. A single agency to coordinate all military research and development;
12. A single agency to integrate all military education and training of the services.

On three of these major points, the services had been unable to agree: (1) creation of a Department of Defense, (2) the over-all status of aviation, and (3) the position of the Marine Corps.

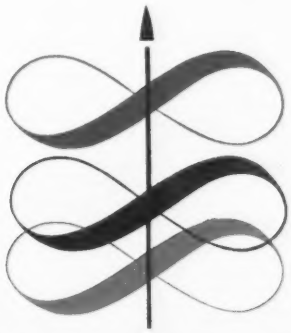
They never did come to true agreement on these and other points, of course, nor have the essential differences among other service viewpoints been fully thrashed out even today. But the immediate product of these postwar disputations and negotiations, which were not yet over by any means, was the first big step toward unification, the National Security Act of 1947. It created the Department of Defense and a separate, coequal Air Force.

Actually, with passage of the act, the antiunification forces hurled themselves into the organizational fray with renewed determination; their stubborn resistance to progressive change has been a feature of the national scene ever since.

Next month: The end of the beginning of the unification fight.

The author, Murray Green, is a civilian aide at Headquarters USAF. This is his fourth article in AIR FORCE/SPACE DIGEST; *most recent previous contribution was an authoritative piece on French missilry in October '60. A second installation on unification will be published in the next issue of this magazine. A lengthy letter from Dr. Green also appears in the "Airmail" department of this issue on page 8. Dr. Green holds B.S. and M.S. degrees from the City College of New York and a Ph.D. from American University, Washington, D. C., in history and international relations. A Reserve major in Air Force intelligence, he served as a naval officer aboard an aircraft carrier in the Pacific in the second World War.*

THE SPACE AGE IN PERSPECTIVE



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An eminent social psychologist comments on indifference and disbelief evidenced by too many of us as the long-predicted Russian manned orbital journey came to pass.

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William V. Shannon 72
That an authoritarian regime, dedicated to the dismantling of freedom, should have written a now-ineradicable page in history is something for all of us to ponder sadly, writes one of the distinguished political columnists of the day.

Yuri Gagarin's Scrapbook
A Photo Essay 78
The day before his flight, the Red Cosmonaut was unknown to the world. After his feat, his likeness was broadcast to all Russia and the world, a tribute to the passion for secrecy and propaganda skills of our Soviet competitors.

Speaking of Space
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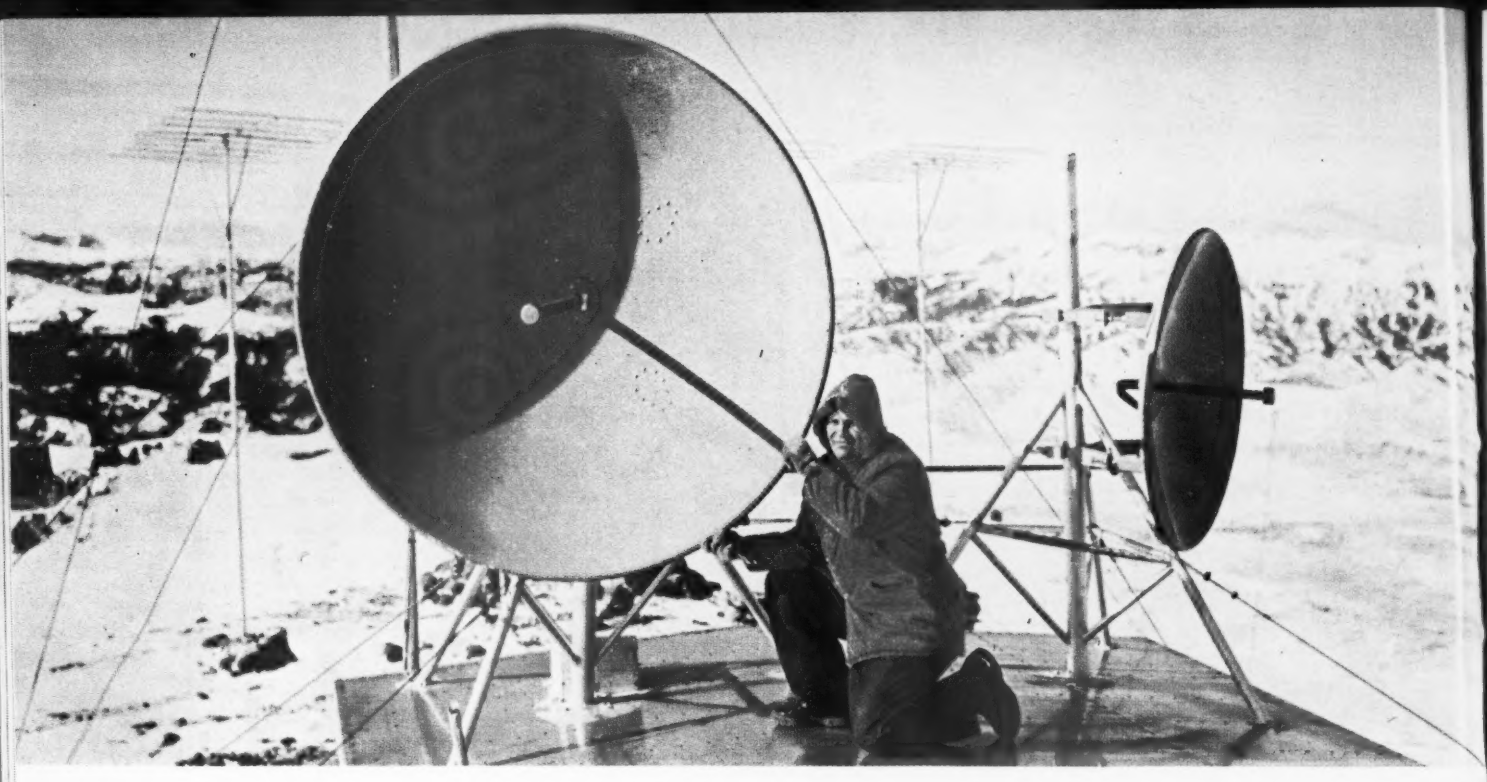

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America's Alan Shepard

Russia's Yuri Gagarin

—Sovfoto

MAN in SPACE— *A Time for Realism and Rededication*

WILLIAM LEAVITT
Associate Editor, SPACE DIGEST

WEEKS have elapsed since the fateful flight of Russia's Yuri Gagarin into orbit and his safe return. Since that significant April 12, the free world has been heartened by the inspiring achievement of US Mercury Astronaut, Navy Commander Alan B. Shepard, Jr., who on May 5 took our American man-in-space program on an important step closer to its objective: orbiting and recovering a manned capsule. There is now the strong hope that Shepard or one of his fellow prime Astronauts will take that orbital ride before the end of 1961. We look forward to the day.

But meanwhile we must await the next Communist astronautical uppercut. Will it be a crew of Red cosmonauts blasted around the planet? An attempt to soft-land an instrument package on the moon to relay data back to earth and unnerve us further? Additional planetary probes? Russian space planners know; we do not. All we do know is that our competitors have seized and intend to retain the initiative in the most dramatic aspect of technology available, the flight of hitherto earth-bound man beyond his planetary confines.

Now, as these events unfold, is an opportune time to analyze some of the arguments we hear

daily by those who find distasteful the fact that we *are* in a cosmic Olympic match with the USSR.

They tell us that the Russian program has been a narrowly focused effort designed primarily for propaganda purposes—and that in contrast our American program has been steady and broad spectrum, that it has produced far greater scientific data. They tell us further that if the world could only understand the scope of our program, the Russian "propaganda-oriented" program would pale, at least slightly, in comparison. *We* discovered the radiation belts, *we* demonstrated the feasibility of communications via space, *we* showed that worldly weather could be observed from orbit. They point to these achievements with pride, and we agree that they are indeed significant feats that deserve maximum world attention.

But let us not make the mistake now of allowing our natural regret and dismay at the lesser impact of our deeds to color falsely our view of what the Russians have done. Although they set up a maximum propaganda howl over their triumphs, and although they quite obviously chose to concentrate on man in space first for its impact, it is idle for us to continue comparisons of the US and USSR efforts in terms which suggest that somehow their program is less scientific, is too narrowly focused, or less orderly in its execution than ours. For if, as is evident, they chose man in space *first* as their objective, the step-by-step approach they used is a classic example of the application of scientific method to technological achievement. First they launched their Sputnik, demonstrating the Goddard and Tsiolkovsky dreams; then they launched, first an animal, later animals, into orbit, and achieved recovery, proving out their life-science techniques and their reentry methods.

Then they went for broke and sent Gagarin into orbit and brought him back alive. True, they took time and effort also to impact the moon, photograph its backside, and launch vehicles into solar orbit and toward the Venerian vicinity. But the main target was man in space first, and they achieved that objective. Perhaps the best historical parallel to such a successful effort in applied science is the Manhattan Project of long ago. Then, because we wanted to and were afraid that our enemies might beat us to the punch, we created the first nuclear explosions. But that was long ago.

If we face the facts as they are, not as we would like them to be, the inescapable conclusion is that *our* programs have been scattered, lacking in direction, overdiscussed, and under-achieved. Even after the disillusionment engendered by Sputnik, when the candid among us admitted that it was a mistake not to have used our existing military missile boosters (whether Army or Air Force) for a satellite launching, rather than starting a "nonmilitary" Vanguard booster program, the Eisenhower Administration stuck to its "space for peace" guns. This romantic view is still too current. Yet there is no blinking the fact that this concentration on what was considered the proper international image cost us dearly in priceless time and effort.

The history of Project Mercury is itself a striking example of switching horses in midstream. To say this is in no way to reflect on the seven brave men who have devoted every waking hour for more than two years to their Mercury Astronaut training program. But there is strong evidence that back in 1959, when NASA took over the national man-in-space effort, the Air Force, under ARPA direction, and working with the old NACA, had just about completed planning for a similar program down to selection of a contractor to build the capsule. The Air Force proposal, a descendant of a 1956 study called Project 7969, had been chosen by ARPA in preference to an Army plan to fire a manned nose cone in a ballistic trajectory (Project Adam: essentially the same feat as the Shepard mission) and a Navy idea (Project MER) to send a man into orbit in a rocket-launched collapsible pneumatic glider. Yet, when NASA took over the man-in-space program, much of the study with industry of the capsule problem was repeated, leading to final selection of a contractor and completion of negotiations in early 1959.

In the words of the First Interim Report on Project Mercury prepared for the House space committee in early 1960:

"In the [Mercury] program that finally emerged the objectives remained the same—namely, to develop a suitable biocapsule to place a man in orbit, to observe his capacity to live and function there, and to recover the man and capsule safely.

"By June 1958, the Air Force had obtained approval from ARPA to proceed with study contracts on the ecological aspects of the manned space capsule, through the construction of a mockup. Two three-month contracts, totaling $740,000, were awarded to North American Aviation, Inc., and General Electric Co., for the life-support system development. The two contractors then started a Phase I development competition for the study and design of a spacecabin and internal

ecological subsystems. The competition was conducted through the contract period, and although a winner was selected, the Air Force program was not continued as the mission was transferred to . . . NASA . . . along with the results of the competition. Another selection process was later initiated by the NASA."

Also, AIR FORCE/SPACE DIGEST readers will recall that in mid-1958, the Air Force was just about to go ahead with a training program for future Astronauts. That story was reported in this magazine in May 1958 ("Blueprint for Tomorrow's Spacecrews").

To note this historical background is not to rake over past and still-controversial technical judgments or management decisions, nor to denigrate the hard work that NASA people, in and out of uniform, have done under heavy pressures to get the agency's programs going. Nor is it noted to suggest that the military, in the services and in the Department of Defense, has been all-seeing and all-knowing. The checkered history of the Saturn engine program, the Army proponents of which risked their careers to advance, is a painful example of indecision at high levels. The ups and down of Dyna-Soar are another example.

We will never know now, of course, whether we might have beaten the Russians into orbit. It is likely that had we shown a real single mindedness on our side of the Iron Curtain after Sputnik, the Russians would have tried even earlier; they had the thrust. The point is that since the initial shock of Sputnik, we have been involved in such an incredible national dialogue over how to react to the Soviet challenge—with some segments of our society even suggesting that we barely react at all—that the energy and direction that might have spurred our national effort has been sadly dissipated.

For example, the portion of the scientific community which luxuriates in the myth that it is part of an international citizenry has devoted an enormous amount of energy to the question of whether man in space is even worthwhile. Reputable scientists have asserted that if all the money going into man in space were spent for cancer or other research, great advances could be made in human welfare. Yet in uttering these shibboleths, they ignore the fact that in the United States today there is no real shortage of money for medical research, that, rather, the shortage is of qualified researchers. And they fail to note that the excitemen and significance of the space age, used as the proper educational frame of reference for today's youngsters, would produce the scientists tomorrow not only to probe the void of outer space but also the inner space of human cellular biology or of the depths of the sea or the mysteries of the subatomic world. It should be noted, of course, that not *all* scientific opinion has followed this view. In every such dialogue, at meetings, on television and through the other media, there are the farsighted who assert that the Soviet challenge *must* be accepted, that space *is* man's new frontier, that beyond prestige, and an improved military-political position, our society will be the better for having accepted the challenge.

The stand-patters in the scientific community are not the only contributors to our disordered dialogue. There are segments of the press, otherwise highly responsible, in favor of social advances, etc., which find a strange fascination with denigrating astronautics and man in space particularly. For example, an article by Stuart Loory in the *Reporter* magazine recently inferred that great things would happen if some of the money going into astronautics went instead to the US Information Agency. More money for a vitalized USIA is fine, but if the USIA obtains funds at the expense of astronautics or other vital programs, then isn't Mr. Loory endorsing the Madison Avenue approach—much money for words when there are no deeds? We must have both words and deeds, as well as the willingness to apply energy and funds to the entire spectrum of necessary national effort.

No matter what the carpers—editorial, scientific, or otherwise—say, this nation and the world are headed toward the twenty-first century. Astronautics is no fad, any more than aviation was. We cannot afford any longer to rationalize our shortcomings. Our partial redemption by the courageous Commander Shepard must presage a new dedication to the urgent American technological task at hand.

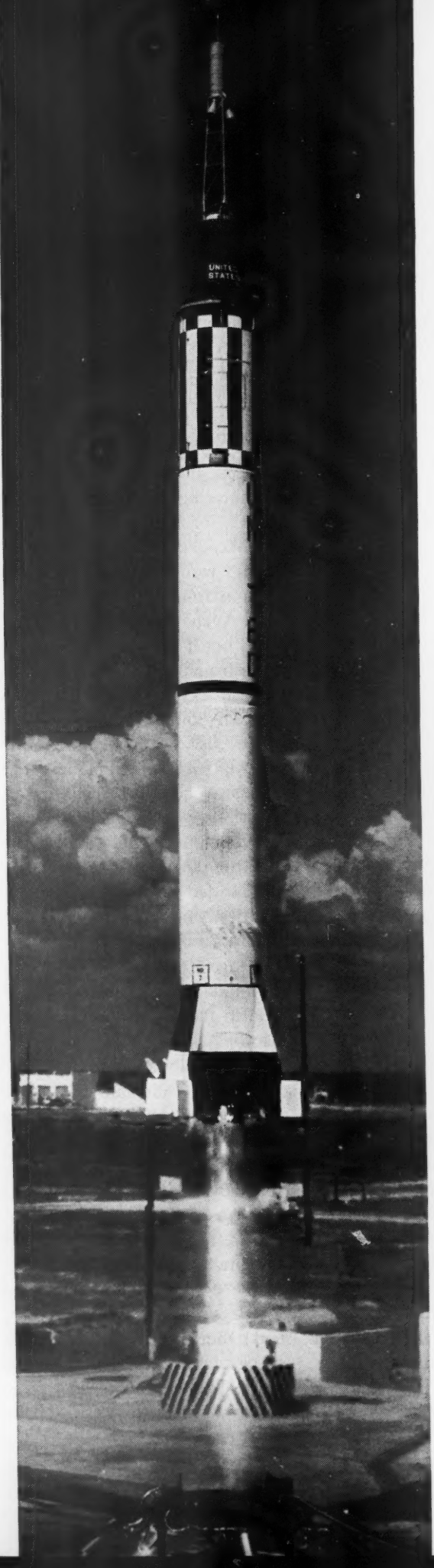
The National Aeronautics and Space Council, under the leadership of Vice President Johnson, is understood to be now examining for the President the entire national space effort. The Council has significant choices to make. It must recommend specific astronautical goals to serve the national and Western cause. These must include maximum efforts, not only to press forward with "working satellite" systems for military, scientific, and eventually, commercial uses (imagine a Soviet sponsored worldwide satellite communications system), but also the will to put *operational* man in space to protect freedom and to explore the universe. There are (*see page 82*) indications that it means to meet this task.—END

Astronaut Shepard's ride into and return from space, short as it was and achieved after the Russian manned orbital feat, nevertheless provided millions of Americans a personal identification with our space effort. For Shepard and his fellow Astronauts the cheers were welcome respite from the pressures of a program the climax of which is yet to come . . . manned orbital flight.

ASTRONAUT SH

—NASA Photo

Astronaut Shepard in his spacesuit aboard capsule just before it was sealed. Once sealed, Shepard had to wait hours before blastoff.



Moment of launch. Redstone lifts gently off the Canaveral pad as millions, including the President, watch telecasting of the first US manned spaceflight.

—NASA Photo

—NASA Photo

Historic flight completed, Shepard, having climbed out of his capsule at ocean impact area, is hoisted up to the recovery helicopter which has quickly spotted him.

—NASA Photo

Crew of recovery ship, Navy carrier Champlain, *scan sky as Marine helicopter brings in Mercury capsule.*

—NASA Photo

Safely aboard the Champlain, *Shepard strides across carrier deck en route to initial medical checkup.*

T SHEPARD'S DAY...

In and Out of Space

IF ANY single event has ever created a sense of personal identification for America's millions with the nation's space efforts, it was the May 5 successful ballistic trajectory flight aboard a Redstone rocket by US Mercury Astronaut, thirty-seven-year-old Navy Commander Alan B. Shepard, Jr.

At the White House, and in homes, offices, and public places across the land, wherever there was a television set or a radio, eyes and ears were watching and listening as Astronaut Shepard, after sitting in his capsule, the Freedom 7, for some hours, finally blasted off at 9:34 a.m. EST atop the Redstone. The nation breathed easier as the lift-off proved perfect and then settled down to follow the fifteen-minute flight that took Shepard up to 115 miles altitude and across 302 miles of flight path to his ocean impact within sight of the recovery carrier, *Lake Champlain,* off the Bahamas.

After careful checks by space medics, who determined that the heavy G-forces, and the weightlessness encountered during the flight had had no deleterious effects, Shepard was flown to Washington for a hero's welcome and award of NASA's Distinguished Service Medal by the President.

For Shepard and his six fellow Astronauts, the cheers were a welcome respite from the pressures of the Mercury program. And the nation hoped soon to see US manned orbital flight.—END

—NASA Photo

Astronaut, flashing smile that soon became familiar across the country, talks it over with medics aboard the airplane that took him from the carrier to Grand Bahama Island for thorough physical examinations.

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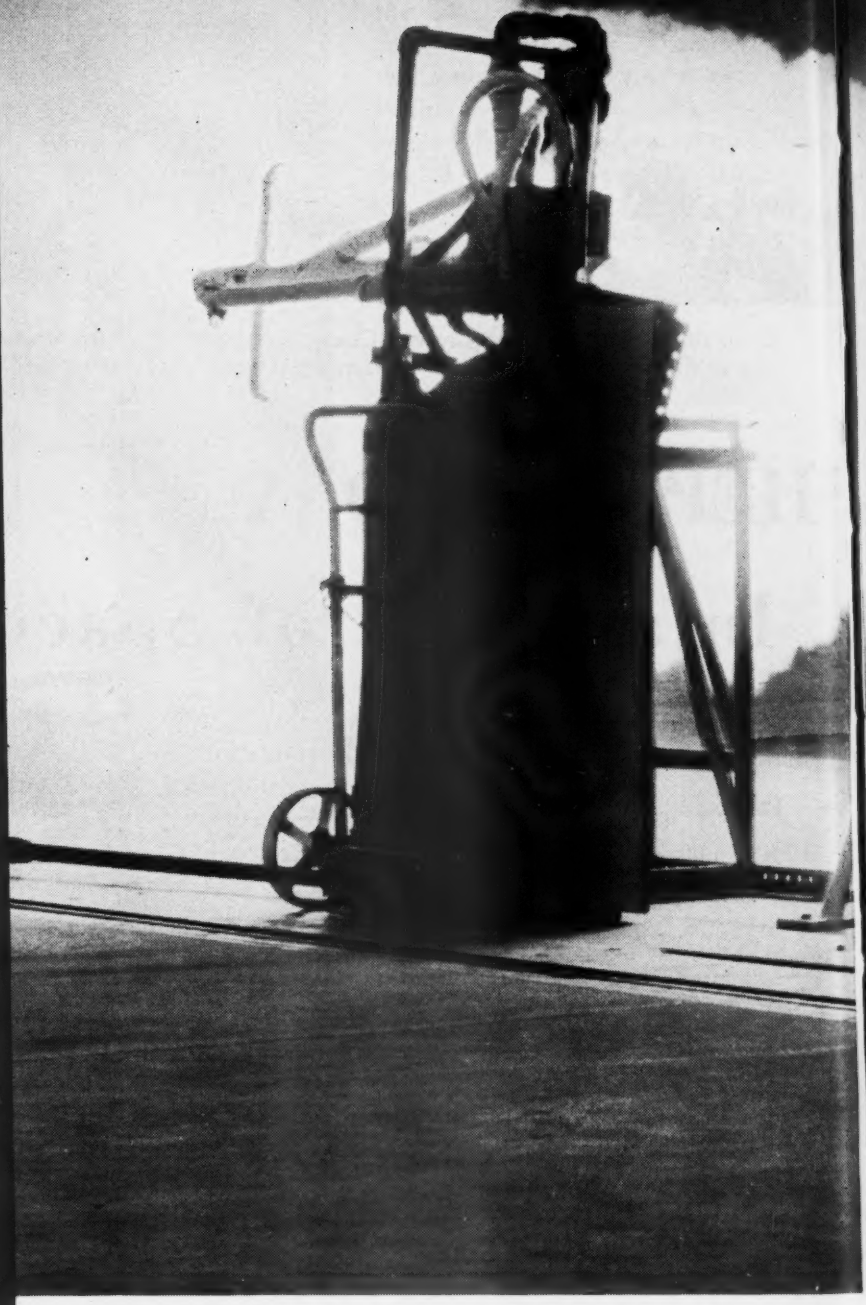
HERE'S HOW WE MEASURE MISSILE MUSCLE



This is one of the test-bays at the Hercules-owned-and-operated plant at Bacchus, Utah. Here the third-stage engine for the Minuteman rocket was developed and is manufactured for the Air Force. The advanced second-stage Polaris engine, developed for the Navy at Allegany Ballistics Laboratory, is also being manufactured here. Hercules' Bacchus plant is a fully integrated facility for research, development, and production line manufacture of high-specific-impulse solid-fueled rocket engines.

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per second over 240 separate input channels, to a central data acquisition room where it is permanently recorded on synchronized magnetic tapes. Meanwhile, as many as twelve high-speed cameras exposing up to 3,000 frames a second on a quarter-mile of film, keep a visual record of everything that happens with thousandths-of-a-second accuracy.

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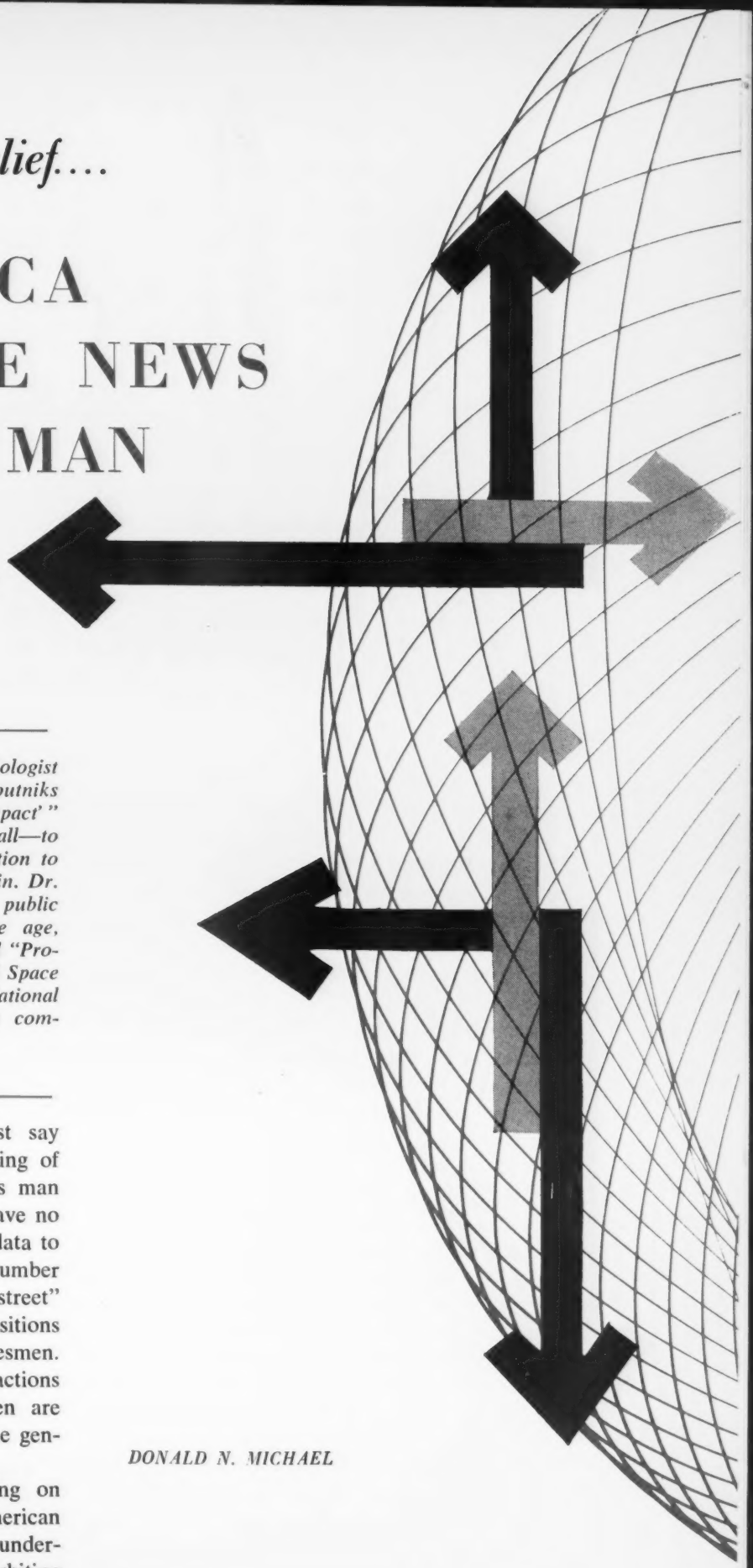
SPERRY

Indifference and Disbelief....

HOW AMERICA VIEWED THE NEWS OF SOVIET MAN IN SPACE



We asked Donald N. Michael, social psychologist at the Brookings Institution—whose article "Sputniks and Public Opinion . . . the Myth of 'Impact'" (SPACE DIGEST, June 1960) readers will recall—to comment on the significance of the US reaction to the orbital spaceflight by Russia's Yuri Gagarin. Dr. Michael, who has been a leading observer of public attitudes toward astronautics and the space age, directed the preparation of the recently issued "Proposed Studies on the Implications of Peaceful Space Activities for Human Affairs" report for the National Aeronautics and Space Administration. His comments follow.—THE EDITORS

WHAT can a social psychologist say about the character and meaning of American reactions to Russia's man in space? At this writing, we have no systematically collected and analyzed poll data to work with, and what follows is based on a number of quick interviews with "the man on the street" as well as on a preliminary analysis of the positions of the mass media and various public spokesmen. This distinction is necessary because the reactions of the mass media and public spokesmen are usually not directly reflective of those of the general public.

Fortunately, or unfortunately, depending on one's values, the behavior of various American groups was not surprising or difficult to understand. Once more, as with Sputnik I, the orbiting of Russia's Cosmonaut provided spokesmen in

DONALD N. MICHAEL

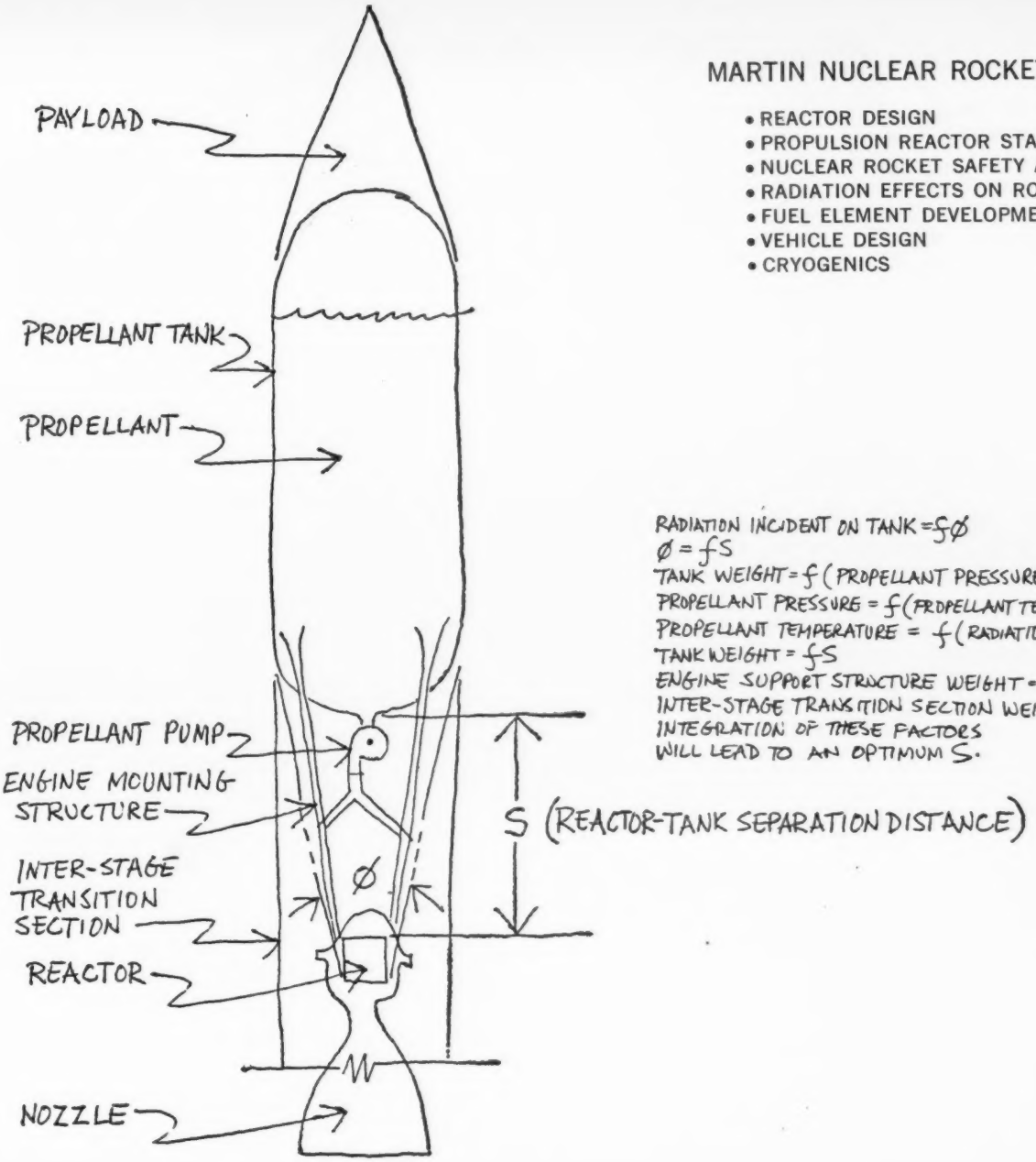
this country with an excellent excuse for drawing attention to their private axe-grinding and their public images. It also provided many Americans with the opportunity to justify—or avoid—their image of themselves and the ways of the world. But probably it provided *most* Americans with not much more than a passing titillation. Some people paid close attention to the "mystery" surrounding the event but, psychologically speaking, the attractions of the mystery had little to do with the significance of the event itself.

Generally speaking—and that's all we can do—the ways various groups of Americans responded to citizen Gagarin's accomplishment are not very different in kind from the ways they reacted to Sputnik I, although the proportions holding various attitudes seem somewhat different.

By far the most frequent responses to the event among the public at large were indifference or disbelief. Why? For some people, either attitude protected them from facing uncomfortable reality, sometimes sensed as Russian technological superiority, but probably more often as the Russian capacity to dig in and work hard to meet goals that transcend those of a new car or a Sunday backyard barbecue. But certainly the majority of those who chose either indifference or disbelief as their response to the Russian man in space, did not do so out of any deep concern with America and space, the sort of concern that is often the *cause* of "denial" psychology. Rather, the indifference was part of the larger indifference that features popular reaction to events remote from popular daily preoccupations, events that still seem magical or circuslike to people. Unemployment, Laos, Cuba, and a multitude of other problems, could preoccupy them far more directly than the eighty-nine-minute circuit of the earth. (These comments also hold as well for most of my social-science colleagues and their sources of funds who ignored this event.)

As for disbelief, one senses that the factor here, in most cases, was a reflection of that unfortunate state of mind which has come to characterize much of the average man's reaction to what happens outside his personal orbit—and, indeed, within it as well. This general attitude is well summed up by the middle-age businessman who said to me, "Aah, everybody's got an angle these days! Who knows what *really* happened?"

But another factor undoubtedly contributed to the widespread feeling that the Russians had committed a hoax, namely, the amount of attention given in Congress and in the press to this possibility. Everyone loves a mystery and everyone would like to make a liar out of his enemy, especially if his enemy makes *him* look foolish by his acts. Also, of course, it's some consolation, if one can't prove technical superiority, to imply moral superiority—especially if one has an uneasy conscience over one's level of national virtue and moral fortitude. The TV scandals still take up space



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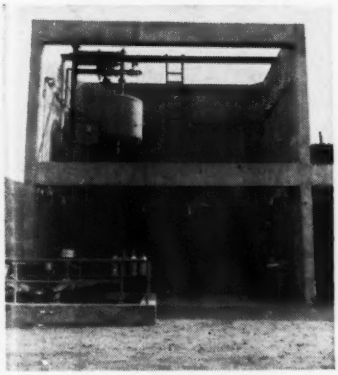
- REACTOR DESIGN
- PROPULSION REACTOR START-UP
- NUCLEAR ROCKET SAFETY ANALYSIS
- RADIATION EFFECTS ON ROCKET SYSTEM
- FUEL ELEMENT DEVELOPMENT
- VEHICLE DESIGN
- CRYOGENICS

RADIATION INCIDENT ON TANK = $f\phi$
$\phi = fS$
TANK WEIGHT = f (PROPELLANT PRESSURE)
PROPELLANT PRESSURE = f (PROPELLANT TEMPERATURE)
PROPELLANT TEMPERATURE = f (RADIATION ON TANK)
TANK WEIGHT = fS
ENGINE SUPPORT STRUCTURE WEIGHT = fS
INTER-STAGE TRANSITION SECTION WEIGHT = fS
INTEGRATION OF THESE FACTORS
WILL LEAD TO AN OPTIMUM S.

THE PROBLEM OF RADIATION HEATING IN NUCLEAR-POWERED ROCKETS



Martin liquid hydrogen test facility at Denver where heat transfer experiments are carried out.

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in the national memory. Thus, in spite of the clear-cut evidence which was available to our government and which was sufficiently definitive for the President to send a wire of congratulations to the Russians, the media chose to play up the *newsy* aspect of the accomplishment; namely, did it *really* happen, and if so, how? The media were treating the differences of interpretation and garbled information precisely the way they would treat the trial of a particularly lurid crime. Also, it appears that many editorialists and columnists sought and found comfort in the spurious belief of hoax, much as they found comfort in the equally spurious assertion four years ago that Sputnik I succeeded because the Russians put all of their technical effort into accomplishing that task at the sacrifice of many others.

As usual, this Russian space accomplishment produced some clamorous and blatant calls-to-arms, with the usual dramatic claims that we must rush all-out to beat the Russians to the moon at any cost in resources and effort. Again, as usual, these assertions were couched in unevaluated conclusions that our national prestige and our military future depended on being in space first with the most. Apparently, either it is not appreciated in many quarters, or if appreciated, not acknowledged, that prestige is a complicated thing, that we know very, very little about the circumstances under which it affects the behavior of others, and that we know even less about the role of space in affecting that behavior. Apparently it seldom occurs to many of those advancing this argument that there may be better ways to project our image overseas than to try and recover the image now lost forever of being *the* dominant technology as we claimed to be in the world before Sputnik I. Finding the most effective role for man in space is not something that can be done by casual and ignorant pronouncements based on biases and bombast, though this is a typically human and very American response to crises.

On the other hand, there seemed to be some signs of maturing of opinion, both public and private, both before and after the event. In the first place, many public spokesmen, including President Kennedy, did respond quickly and fully with public statements congratulating the Russians on their accomplishment. There were, too, in some quarters, calls for a careful assessment of whether or not, and if so, in what ways, man in space is indeed central to the space program in particular and to the fulfillment of America's goals in general. Finally, the media, in collaboration with many spokesmen for science and space, did make a very real effort in the days preceding the Russian accomplishment, as well as in those following it, to make clear that we knew the Russians were going to launch their man first, and that our program could not hope to compare with theirs at this time.

Editorial comment and the remarks of some pundits appeared to be much calmer and less hysterical than they were when Sputnik I took to the heavens. This calmer attitude may reflect a growing maturity; it may also reflect a subtle, growing indifference to space, at least in some of the mass media.

After all, Sputnik I was truly a historical discontinuity, in that it represented the end of the

American technological hegemony and in that it represented the beginning of a new frontier for mankind. In a sense, everything after that was and will be anticlimax. Those people who pay attention to space activities have understood that sooner or later man would go into space and that one nation might do it before the other, but both and perhaps others will do it eventually. On the one hand, this calmness is desirable since it permits in principle at least a cooler estimate of where we go from here. On the other hand, it is discouraging, since it probably indicates, as some of us have foreseen, that man's inherent conservative tendencies have encouraged a routinization of the idea of space and thereby there has been a loss of the quickened sense of life and history that some of us had hoped it would provide.—END

"The news of the Soviet space triumph is . . . as tragic an event as if during World War II Hitler's scientists had gone ahead of us in the race to develop radar or the atomic bomb. . . ."

—Sovfoto

Jubilant Muscovites hail Gagarin, his wife, Khrushchev April 14.

GAGARIN... A Tragedy for the Free World

WILLIAM V. SHANNON

WHEN the Russians confirmed they had put a man in space, President Kennedy, like General Eisenhower on similar occasions in the past, issued the usual polite statement about what a great triumph it is for mankind and for science. It is no triumph. It is a tragedy.

Mankind can draw no pride and no solace from the achievement of a totalitarian system that dwarfs and enslaves man.

Our regret is not motivated by any narrow nationalistic spirit. If the British or French or any other free country had put the first man in space, we could sincerely congratulate them. If we felt any twinges of envy or regret it would only be the innocent kind one experiences in a friendly game or some other civilized rivalry. But that is not true in this instance.

Fate has made us the trustee of mankind's freedom. We are engaged in a desperate, hand-to-hand struggle with the Communists who have already captured control of the great peoples of Russia and China and who want to conquer and enslave all the rest of us. Anything that nourishes the strength of the Soviet ruling clique and enhances its prestige is a misfortune for the cause of freedom. And I include the freedom of the Russian and Chinese people, for if we in the West are resolute and alert and persevering, their long night shall know an end.

The news of the Soviet space triumph is therefore as tragic an event as if during World War II

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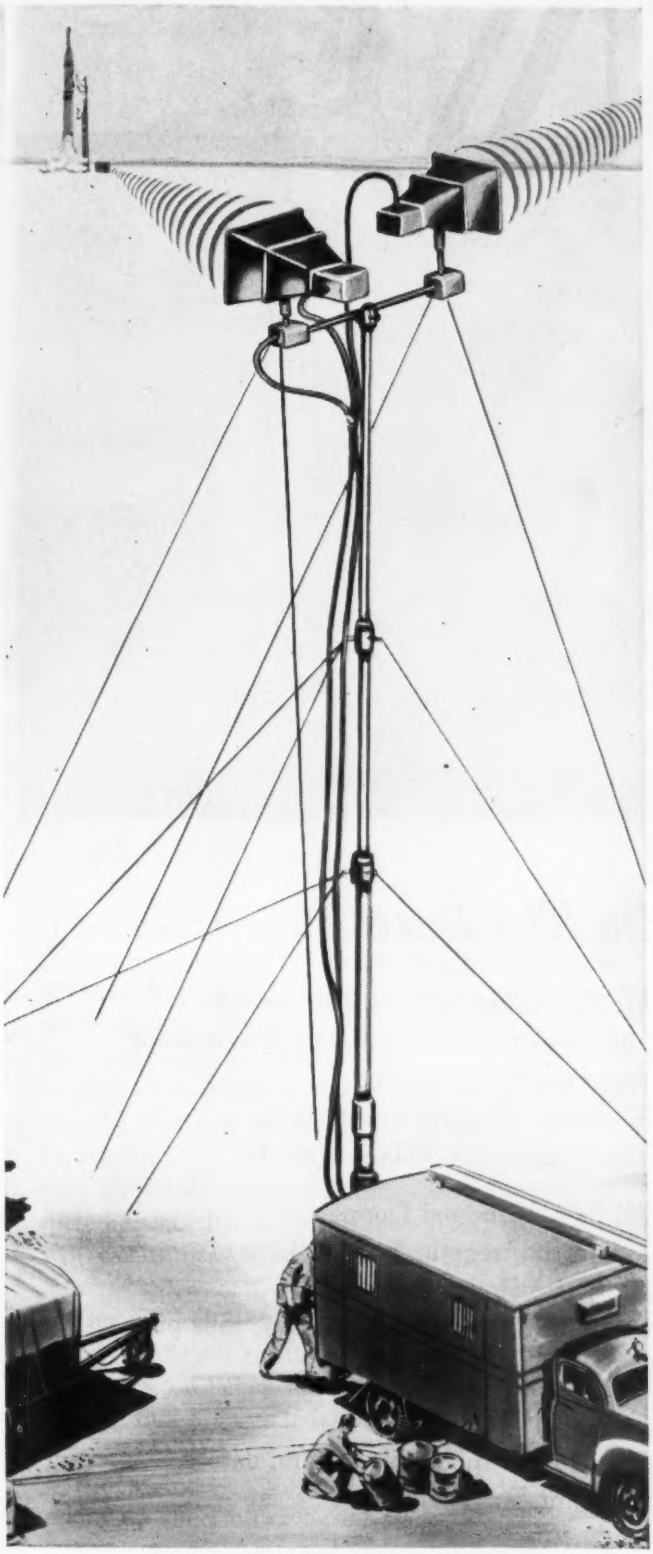

Mobile Station RCA MM-18 Microwave Communication System with portable tower

Standard MM-18 Microwave packages are available from RCA to provide extremely flexible communications systems for mobile applications. Similar to famous RCA equipment that has been proved in use by over a million channel miles, this MM-18 Mobile System provides a broad radio highway over which many teletype channels and duplex voice channels can be operated simultaneously. The directivity of the radio beam and the multiplexing of the communication channels assure a high degree of security for transmitted messages. Truck-mounted, the portable RCA Microwave System also includes a tower that can be rapidly raised and easily transported from one place to another. RCA Mobile Microwave performance matches the reliability found in fixed stations.

MM-18 Systems Ideal for:

- Remote missile bases.
- Command posts to remote launching pads.
- Command post installations for field maneuvers.
- Siting teams requiring high mobility.
- Emergency installations—Civil Defense.

Experienced Microwave engineers will gladly provide additional information. Contact RCA, Dept. W-426, Bldg. 15-1, Camden 2, N.J. or telephone WOodlawn 3-8000, Extension PC-4560.

Also, New MM-600 Microwave Systems. Long haul, high-density systems for fixed installations. Designed to comply with CCIR/CCITT performance standards. Channel capacity of 600 frequency-division multiplexed voice circuits plus service and alarm channel. Alternately, one r-f channel will accommodate 525-line monochrome television; NTSC color TV or 685 CCIR television.

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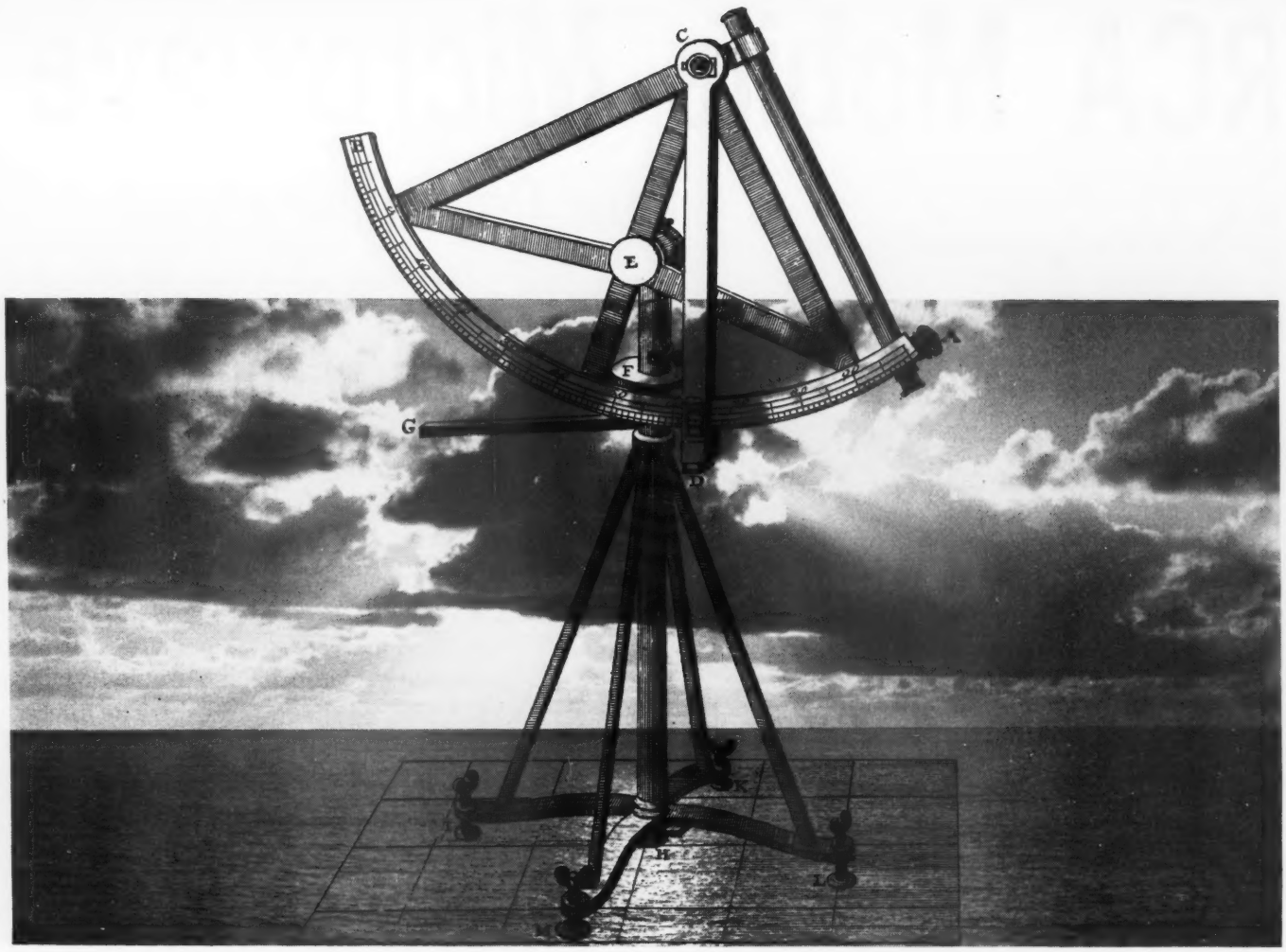

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Hitler's scientists had gone ahead of us in the race to develop radar or the atomic bomb. Science, if divorced from moral purpose, only makes tyranny more efficient. Winston Churchill declared on the day France fell in 1940:

"If we can stand up to him [Hitler], all Europe may be free and the life of the world may move forward into broad, sunlit uplands. But if we fail, then the whole world, including the United States, including all that we have known and cared for, will sink into the abyss of a new dark age made more sinister, and perhaps more protracted, by the lights of perverted science."

We need only substitute ourselves for the British and Khrushchev for Hitler in these sentences to find that Churchill has described our present situation exactly.

It is all too easy to lose sight of the classic simplicity of Churchill's alternatives.

For example, before the year is over we, too, may put a man in space. But this will not cancel out the immense gains in prestige, particularly among the uncommitted peoples, that the Communists have achieved by being first in space.

There is a widespread tendency to minimize the struggle for outer space as a matter of no great importance.

Sherman Adams, after Sputnik in 1957, scoffingly inquired why anyone should care about who was ahead in outer-space basketball. But outer space may be critically important. It may very soon be possible to dominate the earth militarily by establishing weapons platforms in outer space. The military use of space is a subject about which we still know comparatively little.

Undoubtedly, the Soviets concentrate their energies on the more flamboyant and politically exploitable space projects. They are also, like the Nazis, prodigal in using humans for dangerous experiments. Yuri Gagarin is the first man the Soviets have successfully brought back from space, but is he the first man they sent up? But these are side issues.

The central fact remains that we are behind the Soviets in space technology. Our lag is seriously damaging to our political interests; it is potentially a great threat to our military security. We are paying a high price for the antiquated thinking, lack of imagination, and bias against research of former President Eisenhower and former Defense Secretary Wilson.

But the future, not the past, is our primary concern. Is the Kennedy Administration doing enough? Everyone recognizes the deficits of past years cannot be overcome in seventy days. Only in 1963 and 1964 will it begin to be apparent whether the preparations undertaken now were adequate. At least, Kennedy seems not to be as complacent as his predecessor was.

He said in his State-of-the-Union Address on January 29: "The tide of events has been running out, and time has not been our friend. . . . Life in 1961 will not be easy. Wishing it, predicting it, even asking for it, will not make it so. There will be further setbacks before the tide is turned. But turn it we must."

If this spirit is expressed in timely deeds, our free civilization, the heir of Athens, will survive the challenge of this modern Sparta.—END

William V. Shannon is the Washington columnist of the New York Post *and a frequent contributor of political commentary to many publications in this country and abroad. Above is reprinted with permission from the New York* Post *of April 13.*

Where does Hughes fit in the missile picture?

The modern missile ranks as one of man's most ambitious achievements. To design and build an efficient missile requires a wide range of skills — many of which did not even exist a few years ago.

Today, many firms are pooling their special abilities to speed the development of more effective missiles.

Hughes is active in a number of these team projects, as well as in the production of complete missile systems. Here are some examples of Hughes' current missile work:

POLARIS—Hughes is a prime contractor for the production of complete guidance systems for the Navy's sub-launched ballistic missile and is a subcontractor for the fire control system.

FALCON—With both radar and infrared guidance systems, the Falcon family of missiles has demonstrated amazing accuracy and reliability. To date Hughes has delivered to the U.S. Air Force over 30,000 of these high performance air-to-air missiles. And Hughes recently began production on a new nuclear Falcon missile.

SIDEWINDER—This Navy air-to-air missile will carry Hughes infrared detector and cryostat systems in its most advanced models.

MAULER—A highly mobile anti-aircraft and anti-missile missile now being developed for the Army, the Mauler will have a Hughes designed guidance system.

TITAN—Hughes is manufacturing portions of the launch control systems for this Air Force giant.

Hughes is also under contract to investigate the application of Versatile Automatic Test Equipment (VATE) for the guidance systems on the *MINUTEMAN, SKYBOLT, ATLAS, TITAN* and *HOUND DOG* missiles.

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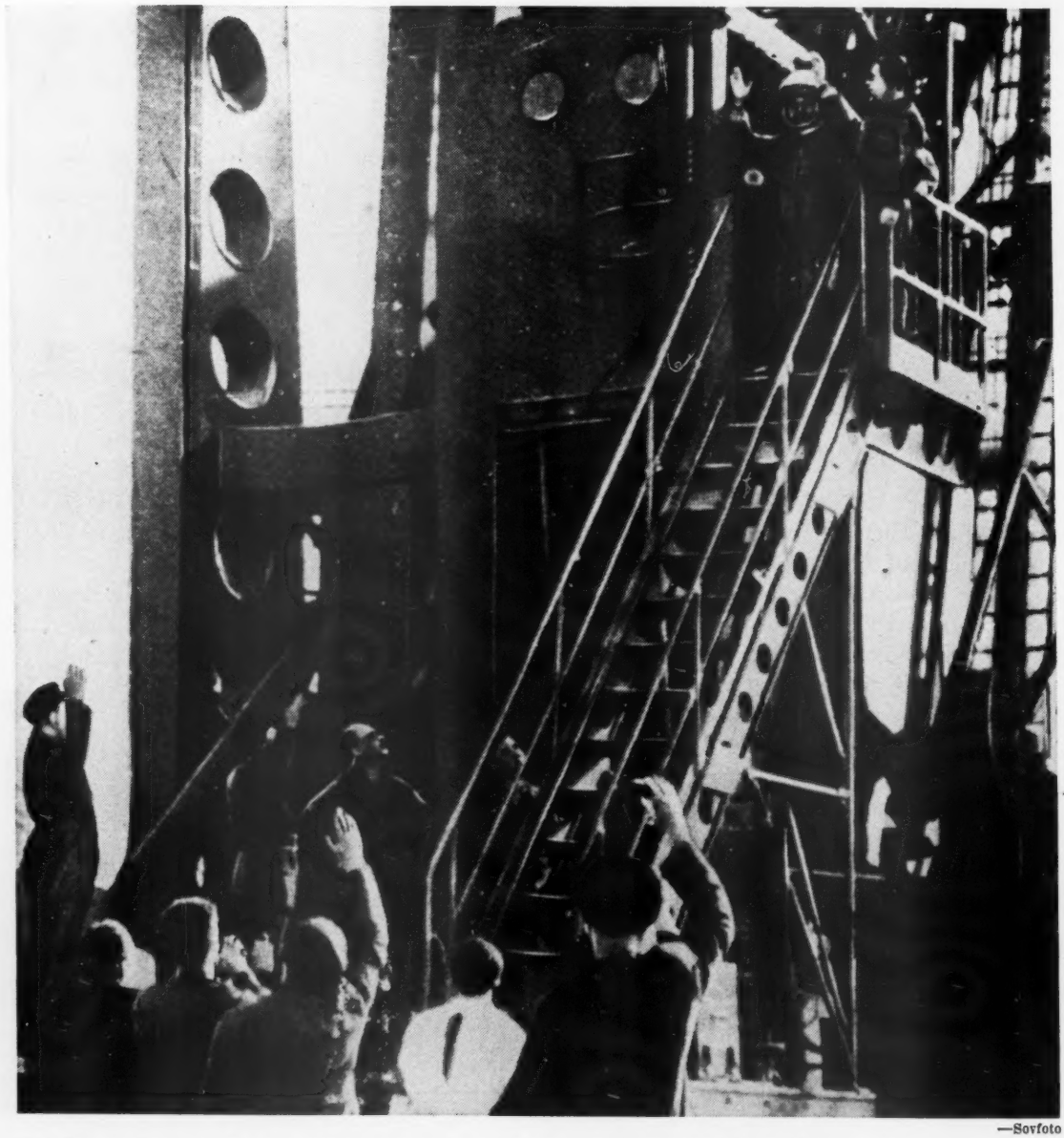
Cosmonaut Gagarin, clad in spacesuit, aboard the van that took him to the launch site the morning of the orbit flight.

—Sovfoto



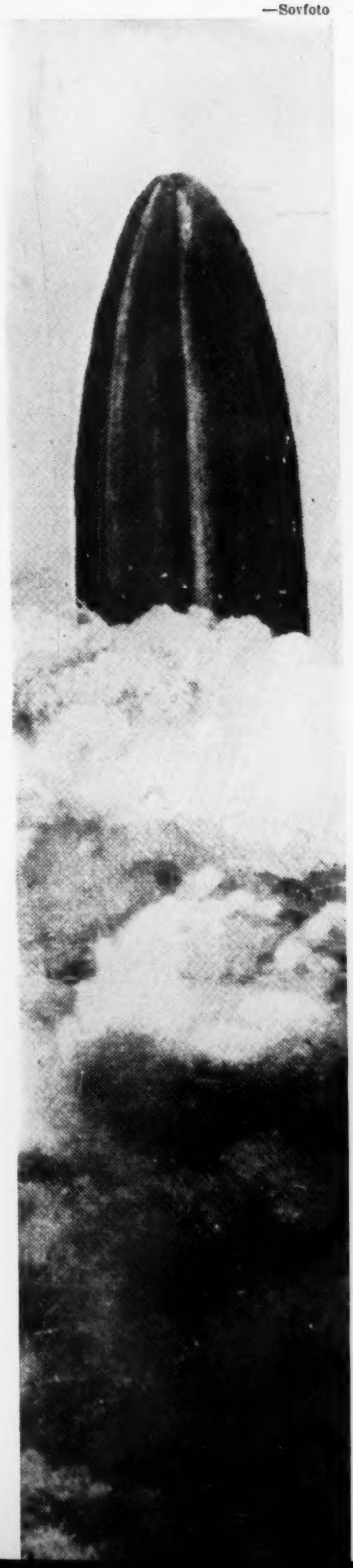
—Sovfoto

The Cosmonaut took time out to wave farewell to technicians on the pad before taking the long ride up to the top of the rocket, where he boarded the capsule for his epochal flight. The world heard the news some hours later.

The Soviets Fete Their Cosmonaut . . .

Yuri Gagarin's Scrapbook

—Sovfoto



Blastoff photo, as released by the Soviets, shows "gigantic spaceship with Yuri Gagarin aboard coming out of the fiery cloud on its flight to the stars."

THE well known Soviet passion for secrecy was strongly exercised in the months and weeks preceding the April 12 orbital flight and return to earth of twenty-seven-year-old Red Air Force Maj. Yuri Gagarin.

Although Gagarin is by now enjoying with his family the status symbol of a new government-furnished five-room apartment, announced as one of his rewards, his name was totally unknown to the world on April 11. Yet within hours of his successful landing, his picture was the most familiar sight in all Russia, a phenomenon the very speed of which is a testament to the propaganda skills of the Soviets.

The genesis of earlier stories a few days before the Gagarin flight that the Russians had recovered an orbiting astronaut who was supposed to have been mentally injured by the flight, will, of course, never be explained. Whether Gagarin was the absolutely first Soviet astronaut, dead or alive, we may never know. But his is the name we will remember.

Here are Soviet photos of the highlights of Gagarin's epochal week.—END

After the flight, the fete. Maj. Gagarin and his wife, left, are honored at a Kremlin reception by a jubilant Khrushchev.

—Sovfoto

LIGHT-WEIGHT UNCOOLED ROCKET NOZZLE

This drawing is representative of advanced material systems application in high-performance solid rocket nozzles.

1 TUNGSTEN LINER resists 5000-6000°F flame temperatures and high mass flow erosion forces.

2 DIFFUSION BARRIER, stable carbide interface, prevents diffusion of carbon into tungsten and eliminates gas pockets between liner and heat sink.

3 GRAPHITE HEAT SINK provides rapid absorption of heat from liner into graphite. Shape is a function of application requirements.

4 CERAMIC INSULATOR presents a high-temperature thermal barrier to restrict heat transfer into plastic insulation.

5 PLASTIC INSULATION serves the dual purpose of preventing overheating of outer wall and adds rigidity to the system.

6 FLANGE AND SPLINE ASSEMBLY of high-strength alloy provides axial load distribution and allows nozzle to be assembled from the inside out.

7 OUTER SHELL of filament-wound plastic provides maximum efficiency on strength-density basis.

MARQUARDT—The Qualified Source for Complete Rocket Nozzle Systems

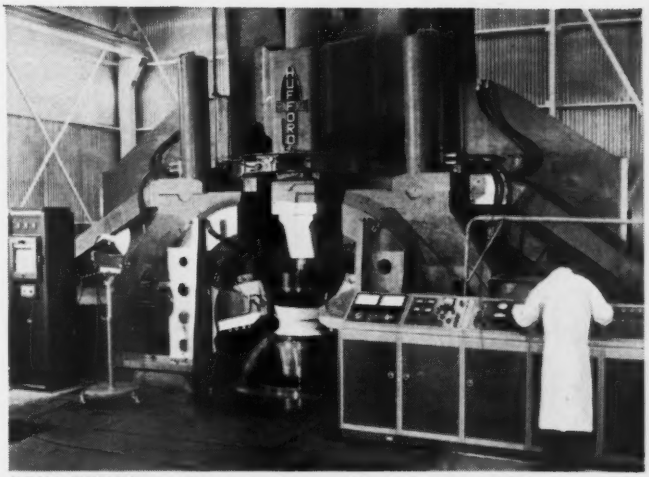
Marquardt's continuing programs of research, development, and fabrication in the ultra-high temperature areas of refractory metals, metal reinforced ceramics, and other composite materials provide a single, complete source for complex rocket nozzle systems. This capability is fully documented by a proven record of materials engineering, processing, and production accomplishments.

Marquardt's unique ability to produce intricate components and systems for the aero-space and defense industries is substantially supported by company sponsored research programs in manufacturing operations. New levels of efficiency and economy in fabricating techniques are tangible results of these programs. Development studies are presently being conducted in high-energy forming of tungsten sheet into radical shapes impractical to form by standard processes; in improving techniques in welding pure tungsten sheet; in producing spin forged tungsten castings and forgings on a high-volume basis.

Significant materials and manufacturing achievements at Marquardt include the development and production of spun tungsten rocket nozzles; a wide variety of nozzle liners and parts; fixed and variable afterburner nozzles; complex attitude propulsion systems and controls; and ramjet nozzles.

Sixteen years of technological experience gained in research, development, and production of a broad range of power systems for atmospheric and space flight are important benefits offered by Marquardt engineers. This leadership combined with extensive facilities provides an exceptional capability for the development and production of reliable high-temperature materials and structures. Detailed information about Marquardt's advanced manufacturing capability may be obtained by writing Corporate Director-Marketing, The Marquardt Corporation, 16555 Saticoy Street, Van Nuys, California.

Engineers and scientists experienced in these or related fields will find it rewarding to discuss career futures with Marquardt. All qualified applicants will receive consideration regardless of race, creed, color, or national origin.



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Speaking of SPACE

WILLIAM LEAVITT
Associate Editor, SPACE DIGEST

For the Administration: An Astronautical Acid Test

The Kennedy Administration, which campaigned for election on a platform that included strong criticism of its predecessor's conservatism on astronautical spending, shows signs of a new philosophy on space programing that will involve heavier funding for fiscal 1962 than it had earlier called for.

Reports from the newly reactivated National Aeronautics and Space Council indicate that the Administration will soon recommend a $600 million increase in spending. On the NASA side, this would be mostly for Apollo, Rover (*see below*), and "working satellite" systems, and would amount to some $500 million, the remaining $100 million going to military space projects. The President, on the heels of the Shepard feat, indicated but did not spell out with any exactitude that he would request additional funds for NASA programs beyond the initial requests made in March, which amounted to some $125 million over the Eisenhower fiscal 1962 request for NASA.

Pressure for more money has been strongest within the House Committee on Science and Astronautics which, during the very week of Astronaut Shepard's successful ballistic flight, authorized some $88.7 million worth of increases over initial Administration requests for fiscal 1962. The committee added $50.2 million to Project Apollo, the proposed NASA successor program to Mercury to orbit a three-man-carrying capsule, first around the earth, and later around the moon; $23.5 million to the NASA-AEC Rover space nuclear propulsion program; and $15 million to the NASA solid-fuel propulsion programs. It should be pointed out, of course, that these are authorizations and not appropriations. Those must come separately and need not be spent by the Kennedy Administration if it chooses to do otherwise.

The President, under the heavy pressure of events ranging from the Cuban failure to the problem of saving what is left of Southeast Asia from the Communists, has more than any man ought to have to think about. He cannot be expected to absorb the technical details of every proposed space program, and is, therefore, heavily dependent on his scientific advisers and the National Aeronautics and Space Council, under the chairmanship of Vice President Johnson, for counsel on what pace the national space program should take. The first group, it is reasonable to suggest, has struggled with a basic question; how can the country catch up with the pace-setting Russians without at the same time establishing the sort of crash programs that politically are almost impossible to operate in a peacetime (albeit cold-war oriented) economy. This basic dilemma is complicated by (*see page 59*) the resistance of a considerable portion of the scientific community which regards man in space as a suspect concept. Like the rest of us, the President's science advisers have to listen to the "go-slow" arguments.

But there are ways, and apparently they are being discussed now, of recouping some of the technological prestige shaken by Soviet advances. Renewed study by the Administration of industry proposals for communication-satellite systems is one indication that "working satellite" systems may be pushed at a fast enough rate so that our technological capabilities can again be dramatically presented to the world.

On the matter of spaceborne communications systems, for example, International Telephone & Telegraph Corp.'s Dr. Henry Busignies puts it this way:

"There is a field where US science and technology stands in the forefront . . . electronic communication. This favorable condition demonstrates the capabilities of the US communications industry. This industry is . . . able . . . to take full advantage of . . . opportunities offered by the space

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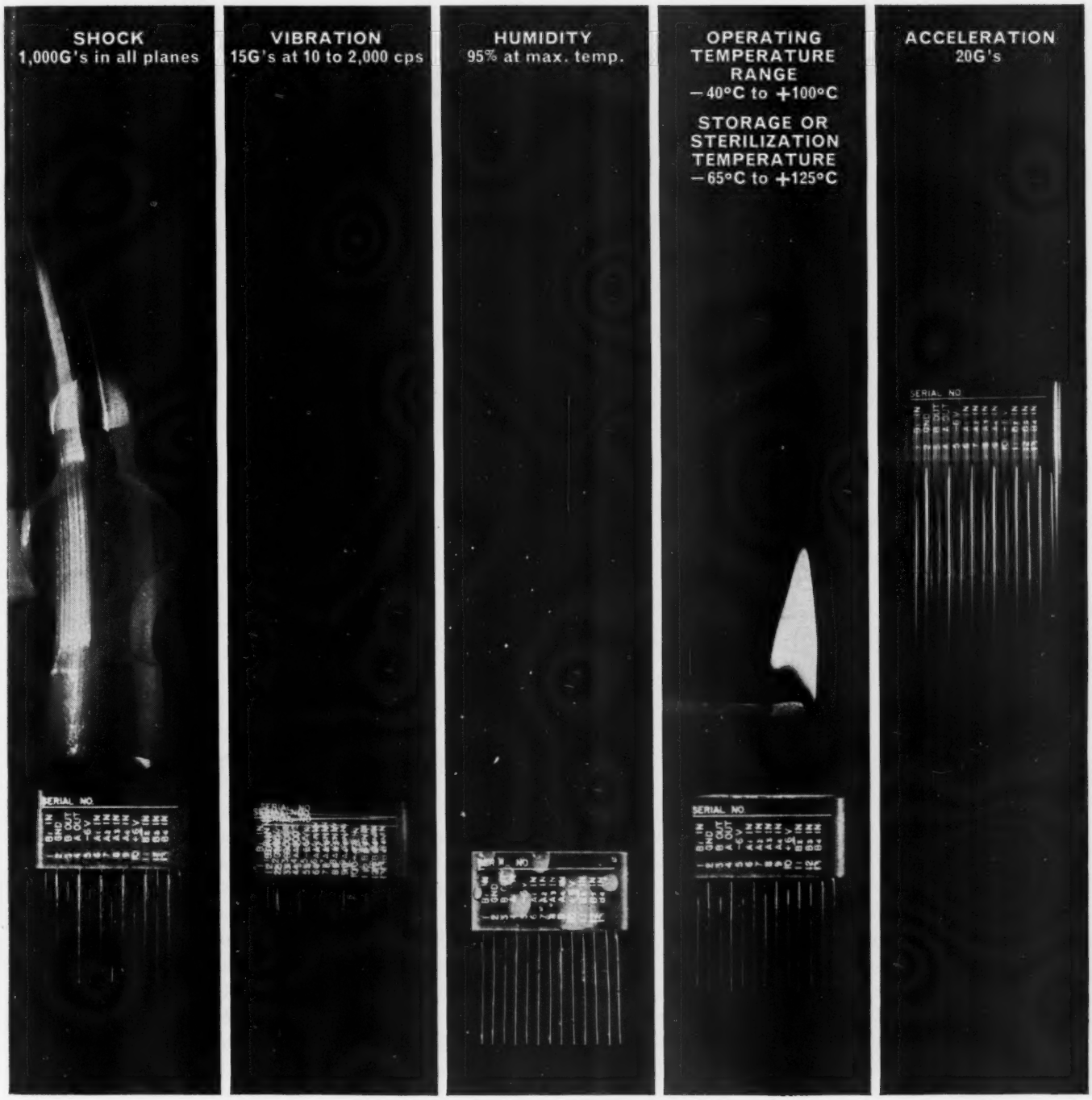

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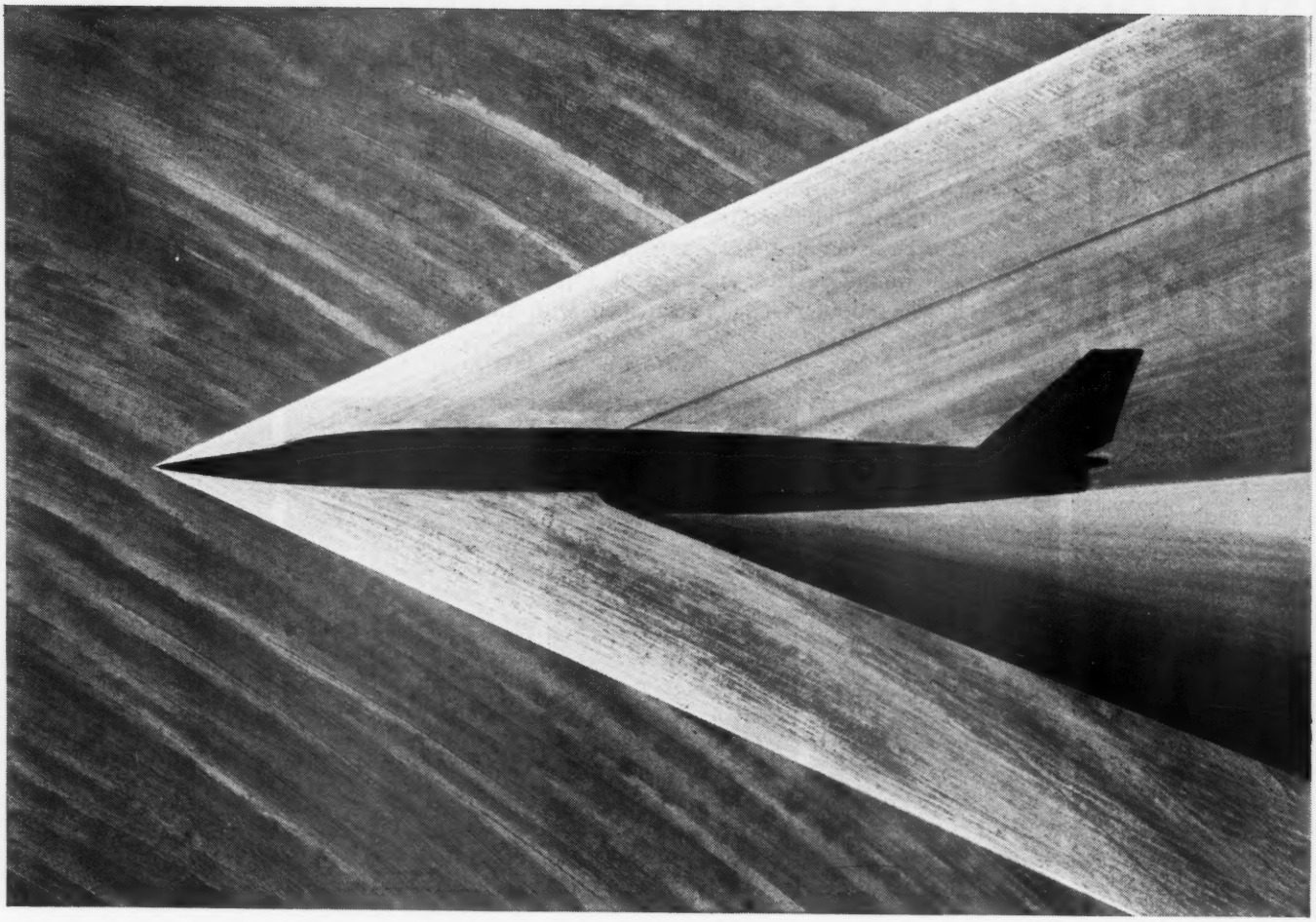


Mach 3 Technology

Designing a plane to ride triple-sonic shock waves like a surfboard

For years manned aircraft have been imprisoned in their own V-shaped shock waves which were created when traveling at high speeds. These waves caused a tremendous increase in drag, and a consequent heavy penalty had to be paid in fuel consumption, limiting the range of supersonic flight.

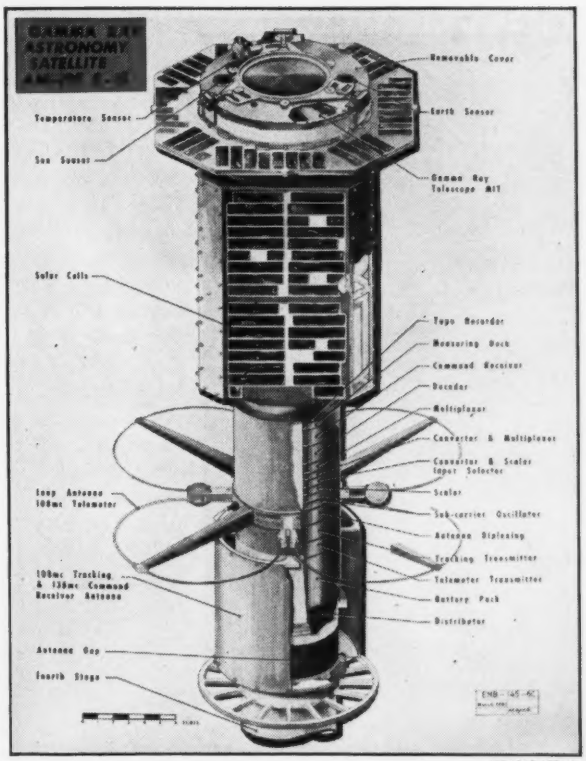
This was the problem facing the engineers at the Los Angeles Division of North American Aviation as they designed the Mach 3 B-70 Valkyrie airplane for the Air Force. The answer lay in an entirely new principle of aerodynamic science which had been discovered by the former National Advisory Committee for Aeronautics. This principle was that, properly designed, a triple-sonic aircraft could actually ride its own air patterns somewhat like a surf-rider on the crest of a wave.

North American engineers set out to design a wing and undersurface which would make use of this aerodynamic principle. The result was a delta wing shaped in the V which would be made by air waves when flying at Mach 3 speeds. The design was highly practical. With this new design advance, there now exists a means for manned aircraft to not only reach triple-sonic dash speeds, but to cruise for intercontinental distances at them.

Advanced design achievements like this will help sustain America's leadership in aircraft by making possible the Mach 3 B-70 and future commercial aircraft.

Builders of the B-70 Valkyrie

THE LOS ANGELES DIVISION OF **NORTH AMERICAN AVIATION, INC.**



—NASA Photo

Artist's rendering of the working parts of NASA's Explorer XI astronomical telescope satellite, sent into orbit from Cape Canaveral April 27. Purpose of the satellite is to determine the sources and nature of gamma and other forms of radiation in space.

age and to make satellite communications a reality of great benefit to the world and to the US and its prestige."

The Space Council's role in Administration space philosophy is apparently emerging strongly. After an overly long wait, Dr. Edward C. Welch, the able former assistant to Senator Symington and a man credited with real understanding of the national space and missile programs, was named to head the Council's staff. Since assuming his post, he has been reviewing all national programs. One question that had cropped up in House committee hearings was whether the Space Council would be purely an advisory body and if so whether such a purely advisory body could provide the needed over-all guidance for a national space program with specific objectives.

Whether the space council would be a management as well as advisory device was a question answered this way by Dr. Welch as he testified to the House committee:

". . . No, except to the extent that giving advice does help management. We would not anticipate the Council would in itself do any managing of other agencies.

"I would also add, referring back to my previous testimony, about resources and effort, that really what we have lacked to a degree has been this necessary sense of urgency as to the question of management."

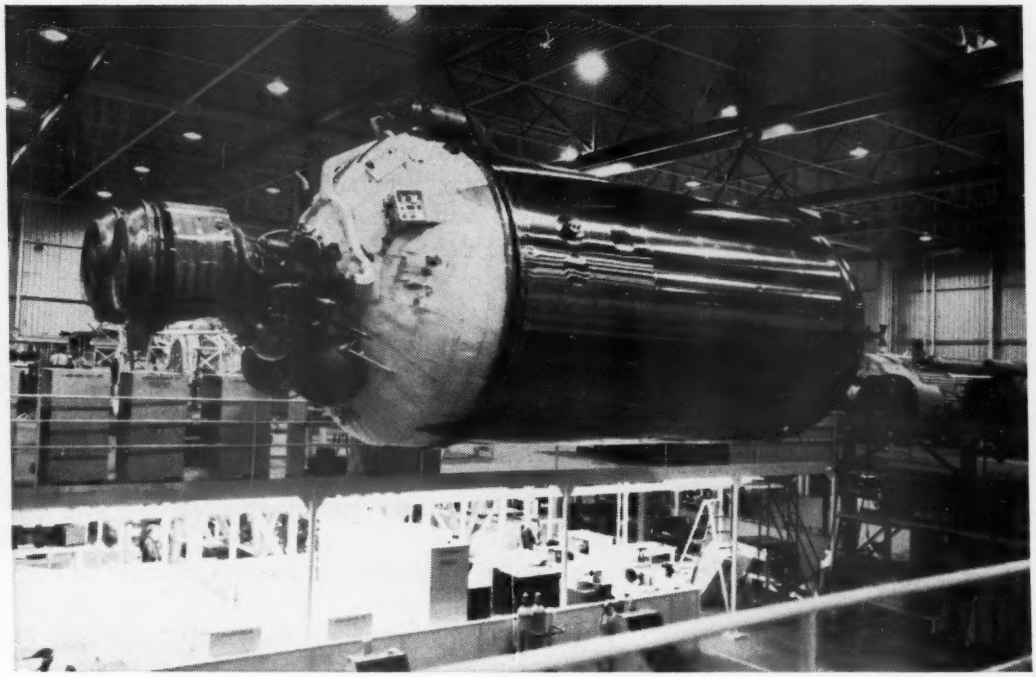
In reply to another question, Dr. Welch added:

"So there isn't any question about my testimony, I want to make it clear we are not going to [manage NASA] or manage the Department of Defense or some other agency."

The fate of the Space Council's reported funding boost urgings will provide a real acid test of the Administration's intentions. If the Space Council's proposals prevail, the signs will point to a really *planned* national program. It has to be admitted, though, that the new Administration's space policy inheritance from its predecessor (and it is not beating a dead horse to point it out) has been incredibly difficult. Programs and policies that were established years ago are hard to alter. On the question of building the thrust needed to put us really in the big-payload, manned and unmanned,

—North American Aviation Inc. Photo

The free world's largest rocket test stand, at Edwards Rocket Site, Calif., to be used to test the 1.5-million-pound-thrust F-1 rocket engine under development for NASA by the Rocketdyne Division of North American Aviation, Inc., is nearing completion. The stand, towering more than 250 feet above the Mojave Desert, will accommodate two of the enormous space engines. Full-scale testing of the F-1 single-chamber engine is expected during the summer of 1961. Each test will check up to 200 separate engine functions, with data relayed to the control center.



NASA's Centaur test vehicle is hoisted from San Diego, Calif., dock prior to trip to Sycamore Canyon, Calif., for engine and system static tests. Centaur engine, liquid-hydrogen-powered, will be capable of orbiting four-and-a-half-ton payloads, also will be used for unmanned lunar landing missions.

business, as many people have insisted, just adding money at this point will not automatically create new impetus. And the organizational structure which was established by the 1958 Space Act is well-nigh frozen into place by now. Empires built are difficult to dismantle.

The nagging question persists—is there some way we can speed up our effort without pushing the panic button?

The answer seems to be the one offered by concerned observers over and over again. It is two-fold. President Kennedy's scientific advisers must press for a policy of boldness in setting national astronautical goals, and this will require strong resistance to the scientific stand-patters who keep perorating against astronautics. It will also require, and this should appeal to the pragmatism of the new Administration, examination of astronautical efforts that can serve not only international prestige needs but also help solve earth-bound problems. The above-mentioned communication-satellite system is certainly a prime candidate for such multipurpose use, as are worldwide weather systems, and the Midas-Samos early-warning and reconnaissance satellite systems, which have been out of the news lately, but which retain their enormous potential for dramatic Western strides in seizing initiative from the Soviets.

The greatest danger now to the US astronautics program, in a very strong sense, is what Donald Michael points out in his commentary on the reaction of the US public and media to the Gagarin feat. Toward the end of his article in this issue (*see page 67*) he talks about what appears to be a routinization of national attitudes toward space. If such a ho-hum feeling is allowed to pervade the new Administration, there is a real danger that the errors of omission of the past several years will be compounded. It is to be fervently hoped that the Space Council's "new frontier" will be explored.

Reporting in Depth

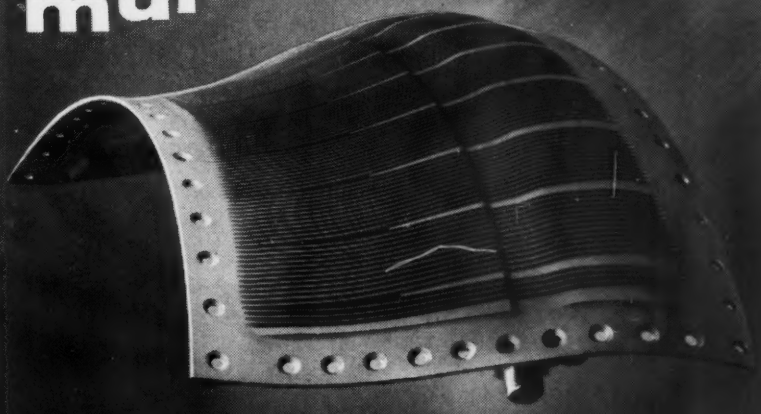
Because so much was written in the press prior to and after the successful Shepard flight which one way or another gave the public the impression that it was a giant step closer to the Russian preeminent position, it is worth quoting in part here an incisive story by William Hines, science editor of the Washington *Star,* published May 4, on the eve of the shoot:

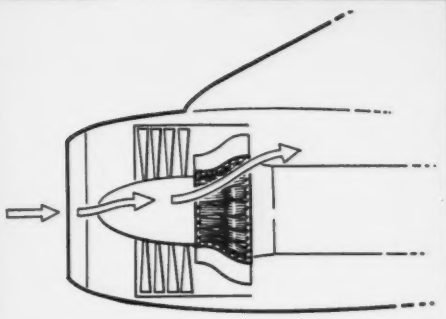
Mr. Hines wrote: "There are probably several million people in the United States today who are firmly convinced that the government is on the point of putting a man in orbit. . . . The imminent . . . launching . . . is not a prolonged man-in-space attempt. Standing by itself, it is not much more than the up-and-down 'Project Adam' exercise which Wernher von Braun suggested a couple of years ago and which was denounced by space administration officials as a 'stunt.' "

"Secondly," Mr. Hines continued, "there is the widespread assumption that profound scientific re-

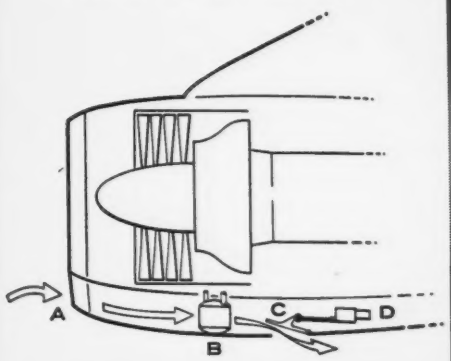
A REVOLUTIONARY CONCEPT IN HEAT TRANSFER DESIGN

multicontoured heat exchangers





Multicontoured oil cooler is section of fan exhaust duct



Conventional oil cooling system includes: A. Duct B. Heat exchanger C. Door D. Actuator

reduce size, weight and drag...

This finned surface oil cooler, used for cooling constant speed drive or turbocompressor lubrication oil circuits, is a structural member of the fan exhaust duct. This eliminates the need for air scoops and special ducting.

These installations are already in use on Boeing 707-720B turbofan aircraft and may be shaped to any configuration at extremely close tolerances. Comparable in price to conventional heat exchangers, they are even more reliable and have a longer service life because of their basic simplicity.

Unique manufacturing techniques developed at AiResearch enable this aluminum unit of welded and all-brazed construction to withstand severe structural and pressure loads. Similar units have been developed for non-by-pass gas turbines and ram air ducts. This major breakthrough in heat exchanger design and fabrication is the result of more than 20 years of experience by the company in the design, development and production of heat transfer equipment.

• *Please direct inquiries to the Los Angeles Division*

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P. O. Box 358, Sunnyvale, California

Full scale physical properties case for one segment being lowered into one of the enormous curing ovens at UTC's Development site.

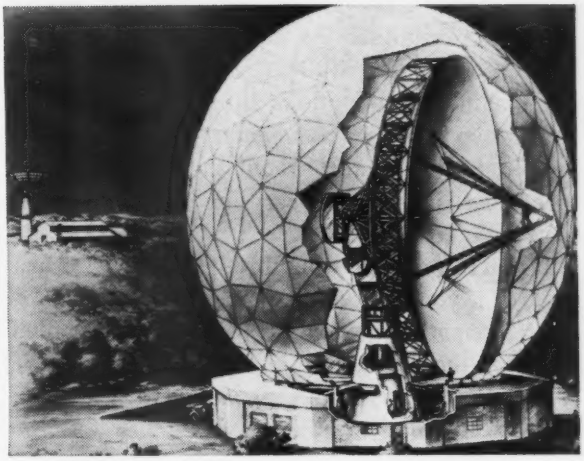
sults are going to flow from the MR-3 flight. Actually, this is primarily an engineering test of a system designed to carry a man into space and sustain him there. Scientific findings are quite likely to be nil. . . . Thirdly, the belief is current that important new thresholds of experience are going to be crossed by Mr. Shepard. The fact is that this Astronaut has already been subjected to all the physical stresses of space life except prolonged weightlessness. . . . Fourth, people seem to think that Commander Shepard will be steering his capsule expertly through space, much as Mr. [Joseph] Walker pilots the X-15. As a matter of fact, Commander Shepard's manipulative tasks will involve limited attitude control of the capsule principally to test his ability to function in zero-G and heavy-gravity situations. In no sense will his life depend on his ability to fly the machine. Fifth, it is assumed that . . . Shepard's flight will provide avid scientists with important answers to questions about spacemen generally. In reality, the only information . . . will be limited data on one very special man. . . . A narrative [by another Astronaut] might be quite different. . . . Finally there is the notion that somehow the major objectives of this flight could not be achieved unless a man was aboard. This is true of only one of the major objectives: that of testing a man in a fifteen-minute flight profile involving six Gs up, eleven Gs down, and five minutes of zero G. . . . How the capsule behaves when occupied by a 170-pound man could . . . be determined with . . . instruments and . . . ballast.

"None of these facts denigrates in any way Commander Shepard's personal valor," Mr. Hines wrote, ". . . but they do serve to place in focus the significance of MR-3. [MR-3] is necessary to test men and equipment for a job that will be done late this year or early next year. This is its total importance."

We have a feeling, after watching and hearing Commander Shepard's post-shot performance, that, were he a newspaperman, he would have written that kind of a straightforward story himself.

Space Capsules

SEN. HUBERT HUMPHREY, Democrat of Minnesota, has proposed a cooperative INTERNATIONAL SPACE YEAR for astronautical research and exploration. Humphrey made the suggestion at the Nineteenth American Assembly, held May 6—day after the successful ballistic flight of Astronaut ALAN B. SHEPARD, JR.—at Columbia University's Arden House. The Senator suggests that the Space Year be patterned after the INTERNATIONAL GEOPHYSICAL YEAR, which he says paved the way for the present international agreement on Antarctica. "We can and should launch an International Space Year with the hope that it would lead to the same type of treaty," he told the Assembly. "We must begin now to seek the conclusion of an agreement that would forbid military activities in outer space or national claims to any bodies or portions of outer space," the Senator added. He also called again for establishment of an INTERNATIONAL SPACE PEACE AGENCY, under auspices of the United Nations, but as a separately functioning organization. Such an agency, under the Senator's plan, would work out space control agreements, develop safeguards and inspection systems.



Artist's sketch of USAF radio and space research facility under construction at Tyngsboro, Mass. The 120-foot-wide saucer-shaped antenna is enclosed in Fiberglas and aluminum radome to provide protection against solar heat and wind pressure damage.

Spaceflight, the magazine of the BRITISH INTERPLANETARY SOCIETY has two interesting, brief articles in its May 1961 issue, one on the capabilities of spaceborne reconnaissance cameras, the other on the possibility of superior galactic communities. . . . An inexpensive paper-bound edition of PROPOSED STUDIES OF THE IMPLICATIONS OF PEACEFUL SPACE ACTIVITIES FOR HUMAN AFFAIRS, prepared by the BROOKINGS INSTITUTION for the National Aeronautics and Space Administration, is available from the Institution. An excerpt from the Brookings report appeared in SPACE DIGEST ("Astronautical Attitudes," February 1961). Write to the Brookings Institution, 1775 Massachusetts Ave., N.W., Washington, D.C., for information and availability. The report

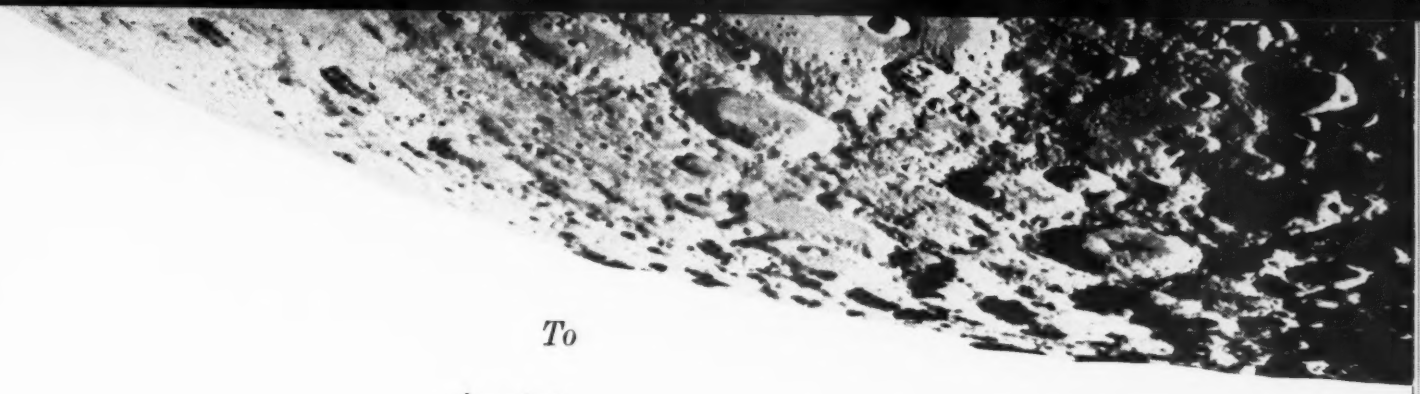
was prepared under the direction of DONALD N. MICHAEL, a social psychologist who has pioneered in the exploration of public attitudes toward astronautics and whose commentary on doubts expressed in this country about the Soviet man-in-space feat in April appears on page 67 of this issue of SPACE DIGEST.

If you're up to plowing through all 1,392 pages of it, or if you want a comprehensive tome on existing thought in the field of space law, you should check on the availability of LEGAL PROBLEMS OF SPACE EXPLORATION—A SYMPOSIUM, prepared by the Legislative Reference Service of the Library of Congress for the SENATE COMMITTEE ON AERONAUTICAL AND SPACE SCIENCES. There is much solid information and opinion in the report, plus excellent bibliographical material. We're pleased to note that AIR FORCE/SPACE DIGEST shows up nearly twenty times in the bibliography. Write to the GOVERNMENT PRINTING OFFICE, Washington 25, D.C., and ask about Document 26, Senate, Eighty-seventh Congress.

A brief and bright study for the interested layman of man's older and newer ideas of the cosmos is offered by *Changing Views of the Universe*, (Macmillan, New York, $3.95, 187 pp.), by Britisher COLIN A. RONAN, a Fellow of the Royal Astronomical Society. The book is the opener in a series of six to be issued under the general title, A SURVEY OF ASTRONOMY. The series, designed for the nontechnical reader, is edited by Mr. Ronan; associate editor is PATRICK MOORE, also a well known British astronomical figure. . . . Another interesting new book is *Music of the Spheres* (Houghton Mifflin, Boston, $6.95, 599 pp.), by GUY MURCHIE, a lyrical journey for the nonscientist reader through the world of space and time. Mr. Murchie, who illustrated the book himself, is a writer who has done everything from schoolteaching to climbing Mount Olympus.

PROFESSIONAL MANPOWER AND EDUCATION IN COMMUNIST CHINA, a report on Red China's efforts to meet present and future technological demands, has been released by the National Science Foundation. Prepared by LEO A. ORLEANS, senior research analyst in the Library of Congress, the report regards Chinese education as impressive in quantity. But it suggests that quality standards are debased by an overly large number of faculties and facilities, and by the pushing of great numbers of Chinese students into programs that combine academic studies, labor, and political indoctrination. "The general quality of the present college graduates in China is usually quite low. Those who received their training in the West prior to 1950 and the few thousand selected students who have been trained in the Soviet Union since then remain the core of the professional manpower," according to the report. Yet, in view of the magnitude of the multifold problem of combating illiteracy, training teachers, developing skilled workers, introducing universal primary education, and developing the core of key scientific and technical personnel, the quantity approach now used seems quite adequate to present national needs, the report says. Copies are available from the Superintendent of Documents, GPO, Washington 25, D.C. Price is $2.—END

Don't move, Ooga, it looks carnivorous!



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CALTECH'S JPL RANGER, to carry research instrument packages to the moon, will rely upon precision design, construction, testing and performance of Motorola electronic equipment. Comprehensive measurements of operational and navigational data aboard will be assembled for transmission by its Flight Data Encoder. An all solid state Transponder generates the telemetry carrier, receives ground commands, and translates carrier frequencies for two-way Doppler velocity measurements. ☆ In laboratories and at launch site, Payload Test Sets will check out the spacecraft RF communications system. At NASA's transmitter and receiver sites, Calibration Beacons will check command transmitter performance and radiate precise signals to test telemetry receivers. ☆ Motorola's participation in Ranger lunar probes demonstrates its space communications capabilities for frontier programs.

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NEXT STOP: MARE IMBRIUM

One of the primary needs in the next generation of our space program is for a reliable "space bus"—a vehicle versatile enough to carry a variety of exploratory packages to the moon and possibly to the near planets. Once it is injected into a lunar or planetary trajectory, this bus will have to guide itself to its destination, accomplish a soft landing, release and activate its payload.

The problems involved in the design and fabrication of such a vehicle, as well as the various payloads it might be expected to deliver, are being intensively explored at Norair. These investigations cover guidance, communications and position sensing systems, thermal and environmental conditioning, structural and material development and a host of other in-house capabilities. Expanded working groups in all essential areas are coordinating their efforts in the search for practical, integrated solutions to these problems.

This determination to research problems as thoroughly as possible, the ability to concentrate such a wide range of technologies toward their solution, and the added ability to translate the results into working hardware are prime assets of Norair in the space age.

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The issue is drawn. The battle is joined. Red and White, implacable enemies, lock in conflict. The start of bloody hostilities? Not quite. This isn't war, it's . . .

WIN, LOSE OR DRAW

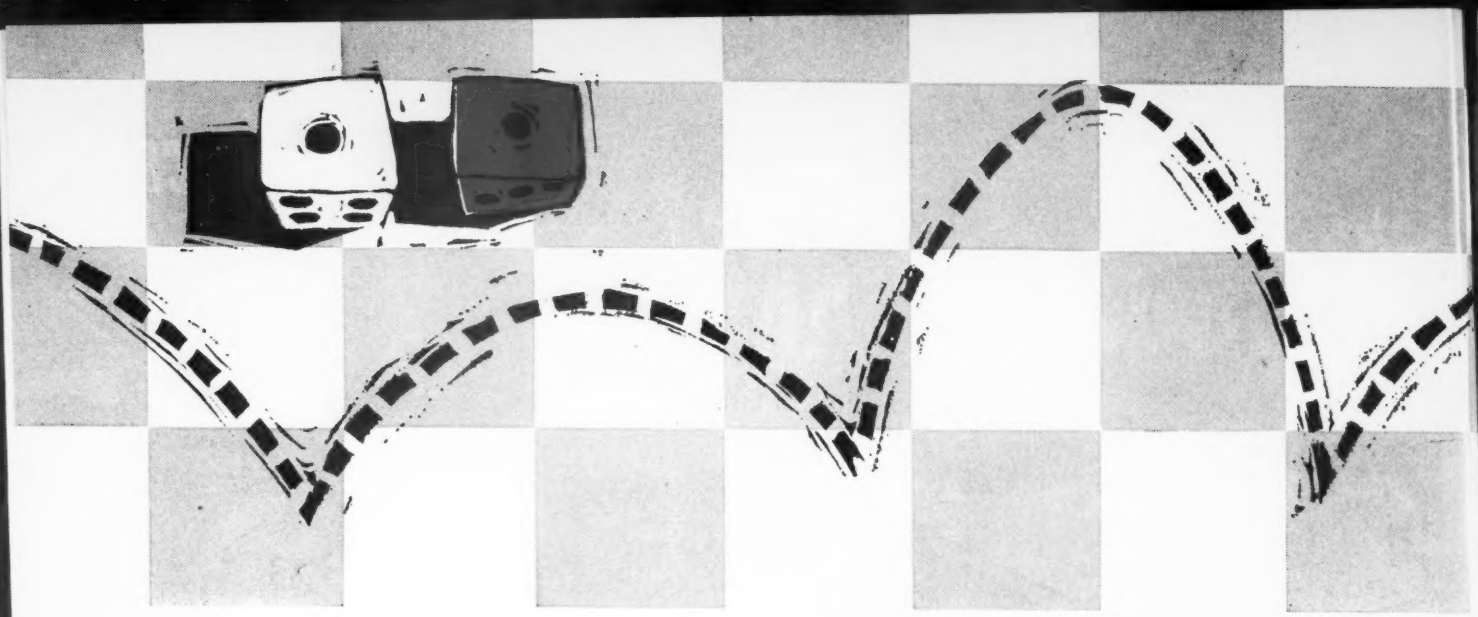
The author, who preferred to remain anonymous, declares a good, home-war-strategy game would be just the thing to develop public understanding of the issues before us. He sets down the rules, declaring that they are "easy" but provide problems closely related to the Real Thing.

DO WE have a missile gap? Deterrent gap? Space gap? Intelligence gap?

I don't know—although I have my suspicions. But what I do know is this: We have a home-strategy-game gap. This creates a further gap in our national grasp of reality in the world around us.

I have before me, I am glad to say, the rules for a game to fill this gap. I will pass them on in due course. First, may I offer these general observations by way of introduction.

Talking about war is the most popular sport of our time.



Strategy is now Everyman's concern.

Pick up almost any edition of your daily newspaper, and there, running through the pages, goes the defense dialogue: Limited war or general war? Manned aircraft or missiles? Massive retaliation or finite deterrence? Should we use tactical nuclear weapons? How much aerospace power is enough to ensure national survival? How much should we spend on defense?

Around and around the arguments rage, in and out of public print, from barber shop to boudoir to board room. Questions of high policy have become very personal things.

But, with all this, do we have a single, simple, at-home method of testing theories and actions to meet national emergencies? At think-factories, at universities, even within government and the armed forces, such test methods, or games, have come into use. There has, however, been nothing at a less professional level to allow wide participation in this critical area of national decision-making. We might consider such a simpler-yet-authentic game as a sort of painting by the numbers in the strategy field—easy, but it gives you the feel of the thing.

Here, then, is a game by which the Amateur Strategist can become more Compleat. The game combines the features of Monopoly (money), chess (strategy), Gettysburg (manipulation), checkers (tactics), bridge (planning), dice (chance), poker (skill), and Tarot (the uncertain future). Some of these elements, naturally, play larger parts than others. Any one can be emphasized by the player.

We might call this new game "Win, Lose, or Draw," a reasonably satisfactory catch-all title. On the other hand, the name of the game really depends on how it is played.

Basic Rules

The Game, at any rate, is a two-person, zero-sum strategic game representing a contest between two coalitions with a possible nuclear duel as the outcome. The price of the real-world game is $41 billion per year for each coalition leader, on a calculated risk basis. This explains why it is a Game only two can play, although individual members of the real-world coalitions would like to *seem* to play.

For the purpose of the game, White and Red countries are prime powers in their respective power blocs (White's bloc is an Alliance), and their preparations to forestall or fight a General War dominate the political and military behavior of their allies. These allies (Red's are called Satellites, a condition of political servitude equivalent to being a Puppet, or Slave State)—are the sum—or "values"—for which White and Red vie. All Red Satellites are Pink by White definition. White allies retain their own colors; several others are Gray.

These imaginary states remain in the Game at all times as values. If a Gray nation turns Pink as the result of some Red gambit, it becomes a positive value accruing to Red and detracts an equal amount from White's prestige. If Red loses a Pink, that state may become a White ally or turn Gray; White values either.

There are a number of Gray states which can obtain—as a general rule—military and economic assistance from either White or Red, depending on the direction of the political rip tide at the moment.

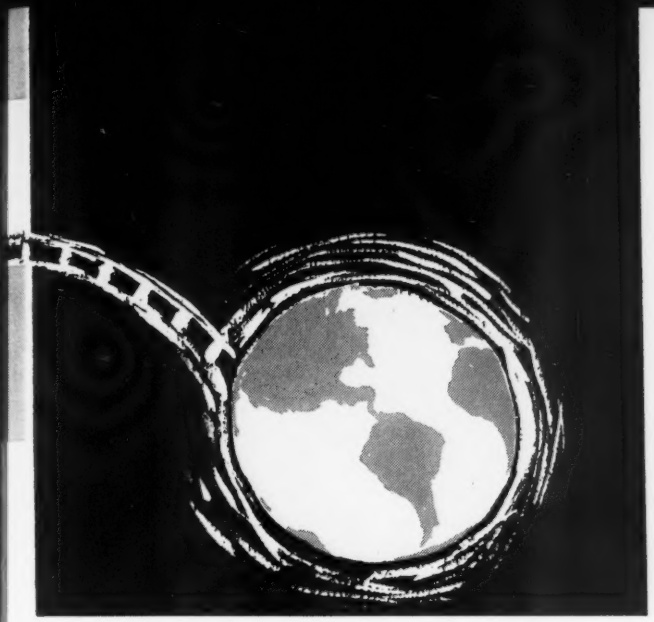
Black Country is more or less Gray, but is recognized as an important value for both White and Red.

A couple of White's allies are beginning to look sort of Rust colored.

If Red loses control over Yellow, its most massive Satellite, the name of the Game may have to be changed.

Simulated defense procurement is fundamental to the Game. Although White and Red have essentially the same defense budgets, Red may buy for a "pure" strategy. In the past, White cherished several systems —or doctrines—simultaneously. It has bought a variety of strategies, with sentimentality sometimes a factor.

The weapons that White and Red will duel with are the product of imagination, technical competence, and decision. Weapon systems discovered with hindsight and then accelerated invoke high-cost penalties. A weapon system which replaces an obsolescent system on an orderly state-of-the-art basis sometimes costs only twice as much as the old one.



Player Policies and Objectives

Peacetime policies and objectives affect the way war starts and the way forces are designed for this contingency. To heighten the possibility of a war with nuclear weapons between the two players, Red is given policies and objectives which differ sharply—and perhaps irreconcilably—from White's.

Red is *committed* by his political dogma to any strategy which will win the countries in White's alliances, and all Gray countries. Red's system is totalitarian, iconoclastic, ruthless. Red has the capability to produce the systems and forces required for any strategy he selects. For instance, being landlocked and closer to most of White's allies than White, Red regards naval forces less in the light of their tradition (rather dismal) than as a means of neutralizing White's mobilization base. Red generally favors the monolithic—as opposed to the precise—approach to war.

Red is capable of initiating hostilities whenever it considers the time ripe for an outright Win. Red believes this, and White believes that Red believes.

Red excels at Gamesmanship, and thinks that the name of the Game is Win.

White Country gives the appearance of favoring a policy of *not Winning*, but of *not Losing* either. In the past, White has considered that it was Winning if it postponed war by maintaining a superior nuclear capability. White has the capability to support a Winning strategy but lately shows a tendency to embrace novel and untested concepts—such as that of a smaller force frightening a larger. Red's doctrine is not clear on deterrence and Red players will continue to deny that it is part of any Red strategy.

White would like to have all Gray countries enter its orbit on a voluntary basis but it is willing to offer inducements to convince the wavering. White doesn't want to acquire Yellow but is nervous about it belonging to Red. (White maintains that it already has the real Yellow. Red neither believes this, nor that White believes that Red believes it.)

White is conditioned by its early history against a strike-first policy except as the result of a gross provocation, like an attempt by the Indians to repossess land. It is more likely to react, in a conventional but unconvincing way, to a kick under the table in its SEATO, which is inflamed and tender from repeated attacks of Khrushchevitis.

Defense Procurement

Each player is issued a ten-year supply of "money" at the start of the Game, or $410 billion. White Country is rich, and, having the most to lose, allocates nine percent of its Gross National Product for defense. Red is comparatively poor, but hopes to become rich, and devotes some twenty-five percent of its GNP to military spending.

Players buy hardware and forces toward an end position of ten years—game time—from the start of play. The price of defense items is roughly equivalent for both. If the players have a strategy and force structure in mind at the start, procurement is simplified. Red's procurement rate is 5/3 as fast as White's.

Red pays nothing for intelligence, this being both free and the privilege of White's fourth estate to report and comment on. White buys all intelligence (Red being a closed society,) and is roundly abused for doing so. Half of what Red procures in hardware and bases is unknown to White.

To be credible for either player, a "Win" strategy must include substantial sums for civil defense.

Money spent on research and development can have an important payoff in weapon effectiveness. Substantial sums invested in research for an anti-ICBM, for instance, might reduce Red or White missile worth by a factor of four. Probabilities of breakthroughs are determined by chance, as a one-in-270 proposition. Ultraexotic and "absolute" weapons cannot be ruled out altogether, but the probability of attainment jumps to one-in-588: equivalent to drawing a pat full house.

Game Materials

The Game is played on a polar projection, scale 1:10,000,000. For ease of play, grid overlays are provided; the distance between grid sections is 500 nautical miles, related to the speed of current jet bombers. B-70 type weapon carriers move four spaces at a time.

There is no grid for missiles. Missile action is treated as instantaneous.

Grids for movement of surface forces can be made, but Mercator projections must be used and the scale reduced to 1:1,000,000. Surface movements also require a slower Game time (on the order of 400-to-one) and a larger Game room: a vacant hangar to accommodate the necessary maps, if one is available.

Maps of the *near* lunar landscape can be had from the United States Army Corps of Engineers.

For accounting purposes, elements with a nuclear capability are represented by individual symbols. These may be cut out of advertisements in current

(Continued on following page)

periodicals and pasted on cardboard. Technical data can be obtained from British, French, and Swiss trade publications. Editorials from these magazines and many newspapers can also be used for planning guidance, such as how to avoid "gapping." A single clock regulates play, and measures minutes with equal impartiality for both contestants. Under no condition can either turn the clock back to an earlier hour.

Possible Strategies

There are several strategic choices available to White and Red. To the extent that either is a disciple of Kahn, Type I, II, or III Deterrence may seem valid. Counterforce and counternation forces can be accommodated within one or the other, including some variations on both. *Fortune* Magazine readers may prefer the all-wet Morgenstern plan of minimum deterrence. The Army player will, *of necessity, choose* Kissinger.

Red might, for instance, decide to put its confidence in a massive rocket salvo aimed to deprive White of its counterattack capability, followed—if successful—by an ultimatum. The less of White's force surviving, the more difficult White's decision regarding his response.

White might elect to go in heavily for warning, protective measures, civil defense, and force mobility, to lower Red's confidence about the value of a surprise assault.

Red might risk a counternation strategy, after taking measures to remove its population from the line of fire, and depend on faster recuperation to advance it to a dominate position.

White might sensibly conclude that even nuclear war can have some depth, and that unchallenged access to Red Country with a collateral capability to attrite its hold-back and last-resort forces seems promising; more so since it does not invite the destruction of White's own population.

Red might hope to trick White into preparing for a conventional war (flame throwers, iron-clads, Bouncing Betties, thermite and napalm bombs, bluenose bullets, steel darts, and the like) on the basis of morality or obligation to later generations, in order to engulf White later in a Red iron tide.

White might be deluded into a bargain-basement plan based on the premise that nuclear war is unthinkable, so the less spent on preparation for it the better. Hope for Peace never stood on a shakier scaffold than this.

It would be an irony of cosmic proportions to end the Game with surviving White living on a Red reservation.

Rules for Play

RULE I. There is one indisputable Rule and it overrides all others. Despite White's seeming confusion on this score at times, it is necessary to play the Game to Win.

RULE II. White and Red roll dice for the first move. White moves first if either die *stands on edge.*

RULE III. Red can see White Country, but White cannot see Red Country until after play starts.

RULE IV. Players *should* communicate with each other during play. There is no requirement for either to be truthful, except that, before war starts, Red can easily verify what it hears. White can find out whether or not Red was bluffing after war starts.

RULE V. A. Either side may ask for an armistice once during the course of the Game. Procurement may be resumed during the period of the armistice.

B. No new arms may be introduced during an armistice *except by Red.*

C. Either side may terminate the armistice without notice, *except White.*

RULE VI. Red may declare a "Gap" once against any of White's weapon systems. White automatically loses a turn while closing the Gap.

RULE VII. A "reprisal" strategy initiated by either side results in a Draw, since neither side can Win thereafter. If others are waiting, White and Red must wait their turn again. When Yellow Country is ready to play in this no-limit Game, White and Red might do well to conserve their resources.

RULE VIII. A Win must fulfill these conditions: The Winner (a) has most of his population centers and alliances intact; (b) holds a margin in numbers of weapons and has a means to deliver them; (c) retains a reliable way to reconnoiter the opponent's area in order to improvise conclusive attacks; and (d) can deny access to his own area and thus remove the Loser's ability to continue logical resistance.

RULE IX. By custom, the Winner stands treat as long as there are takers.

The Payoff

Players will be impressed differently by the result. Thrifty players will view savings as an important Win, though several Allies (or Satellites) turn Gray. Aggressive players may evaluate the result in a comparison of casualties: 60,000,000 dead is a "better" outcome than 80,000,000; or 100,000,000 is not much "worse" than 60,000,000.

Poker players may find an apparent bluff can conceal a full house, and bridge players that finesse has other meanings. Crapshooters do not always excel at "liar's dice" though the materials are the same. Chess players will be annoyed that a stalemate vanishes when the opponent pushes his pawns from R and D into the king-sized weapons row. Checker players will probably find the speed of play dismaying and suggest an electronic assistant.

Never mind. The world learns by doing, and mistakes are inevitable. The money is not real money, after all. Let the player who loses console himself in the fact that he is still alive and free to enjoy the pursuit of whatever he defines as happiness.

And, after all, there's always a "next time" in the Game. This is where it differs most radically from the Real Thing in the world of today.—END

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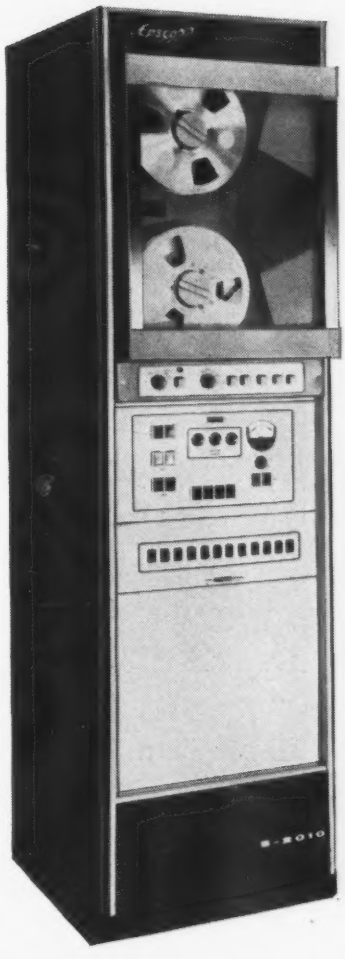

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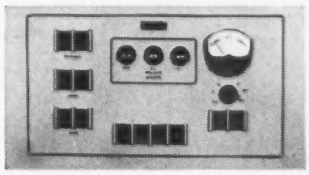
Modes of Operation: Continuous or start-stop. Binary or BCD output. Variable record length control. Data programming. Self-checking test mode. On-line or off-line monitoring. Single or double memory operation. Data source control.

Construction: All solid-state, with quick-change, indexed plug-in circuit cards. Key logical elements have indicator lights, and all cards have test points brought out and identified.



Dimensions: Standard models, one standard 19-inch cabinet, 82" h x 22" w x 24" d.

Operating Environment: Temperature 32° F to 100° F, cooling by built-in ducting and blowers. Relative humidity: up to 90%. Altitude: up to 8000' above sea level.

Thermal Dissipation: 2250 BTU (mean).

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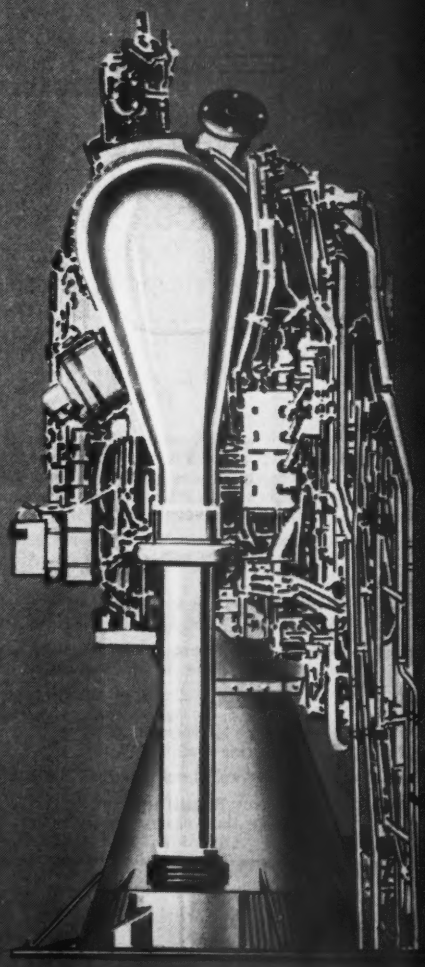

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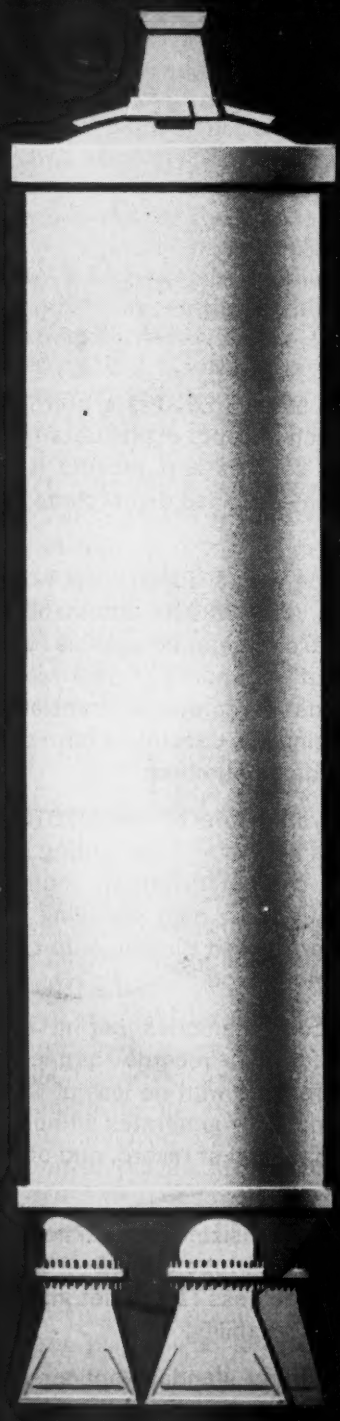

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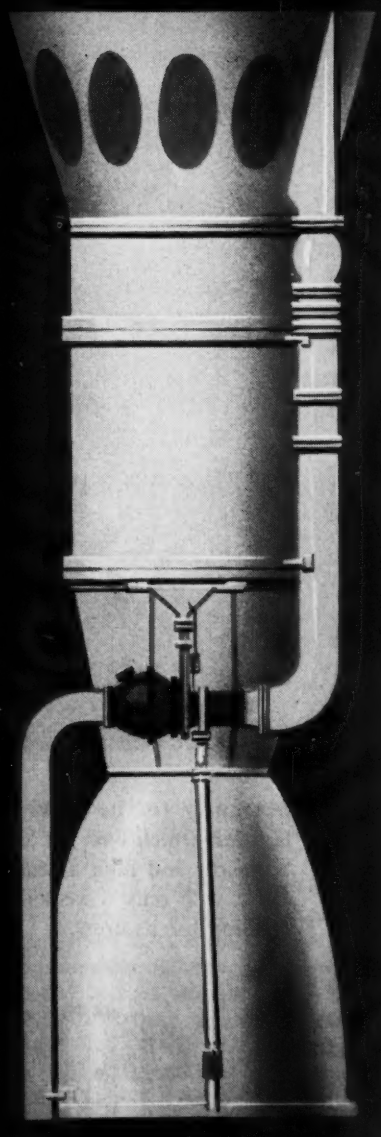

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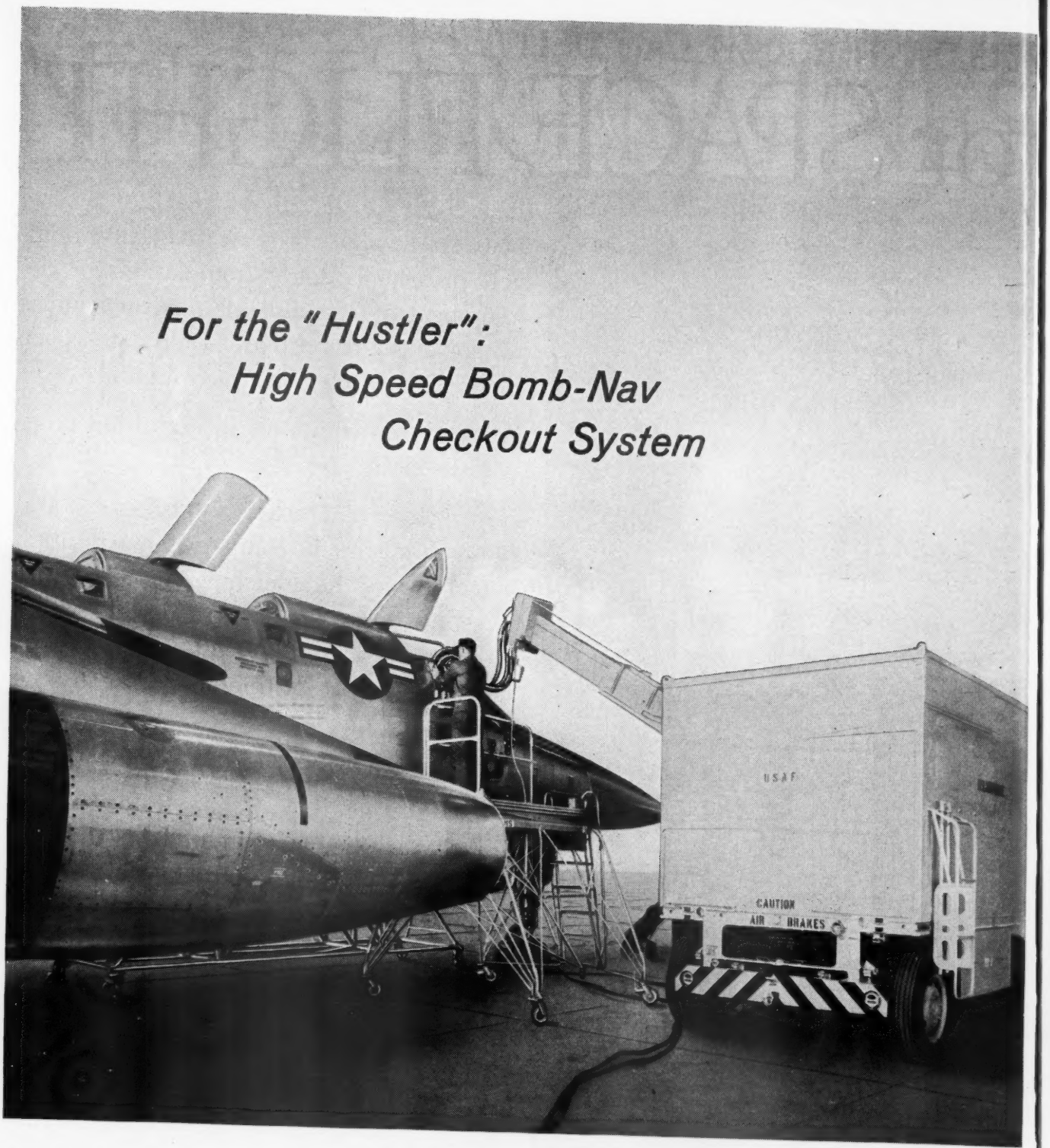
THIOKOL

CHEMICAL CORPORATION

Rockets Operations Center, Ogden, Utah



A new, high speed automatic checkout system developed for Convair by Sperry can make up to 3,600 different line checks on the complex bomb-nav system of the B-58 Hustler, most of which require only 4 seconds to set and complete.

In a mobile van Flight Line Tester coupled to the B-58, the AGE (Aerospace Ground Equipment) performs desired checks which are programmed by punched tape. Visual "go, no-go" readout is provided. In event of malfunction, additional rapid automatic measurements are made in repair-shop installed test sets to pinpoint the trouble.

This advanced system is now undergoing final Air Force evaluations at Carswell AFB. Significantly faster than conventional checkout methods, the highly efficient Sperry AGE system also increases the accuracy, simplicity and flexibility of testing.

The Sperry-developed bombing-navigation system has contributed importantly to the newly operational Hustler, which won the SAC trophy for both low and high altitude bombing in 1960, with only 6 weeks of operational training for its crew.

SPERRY

AIR ARMAMENT DIVISION, *SPERRY GYROSCOPE COMPANY, DIVISION OF SPERRY RAND CORPORATION, GREAT NECK, NEW YORK*

the Ready Room

RESERVE AND AIR GUARD NEWS

Air Guard Council Meets

Increases in the Air National Guard **fiscal 1962 budget** totaling $13.6 million have been recommended by **AFA's Air Guard Council.**

The Council met April 20 at **Ellington AFB, Tex.,** under its chairman, **Brig. Gen. Frank A. Bailey** of Arkansas, in conjunction with the ANG Commanders' Conference. The Council's recommendations, addressed to **AFA's Board of Directors,** pointed out that the Department of Defense budget provides the ANG with virtually the **same amount of money in fiscal 1962** as it had in fiscal 1961.

It declared as essential an **increase of $2 million for ANG personnel, $3 million for operations and maintenance, and $8.6 million for construction to accommodate heavier and higher-performance aircraft.**

"The assignment to the Air Guard of **more modern, complex, and costlier aircraft,** and the assumption by the Guard of **more responsible missions** on behalf of the US Air Force, coupled with a **continued rise in the nation's cost of living,** requires that the Air National Guard be given these additional funds," the Council said. "The disturbing increase so far this year in the Air National Guard's flying safety rate is a **grim warning that more funds are needed.**

"It is impossible to expect the Guard to deliver more and more each year without providing the **resources necessary to sustain its efforts.** To continue to ignore this clear requirement may prove in the end to be vastly more costly to the nation in terms of lives, equipment, and weakened combat capability."

The Council received a preliminary report from **Lt. Col. David McCallister,** who heads subcommittees on the ground support tactical fighter and on missile booster recovery. Colonel McCallister will present a detailed report on these subjects at the **Council's next meeting in Colorado Springs** early this month.

Reserve Forces Policy Committee Recommendations

A recommendation that **personnel in recovery and support units** should continue to be authorized **forty-eight paid drills** per year was approved by the **Air Reserve Forces Policy Committee** at its April meeting in Washington.

This is **one of five recommendations** made by the committee from a slate of **fifteen agenda items.** The five have been forwarded to the Secretary of the Air Force for his consideration.

In another action, the committee recommended that an officer **promoted under ROPA** or other "centralized selection procedure" while on a four-year specified active-duty tour should be **entitled to the higher rank immediately.**

Present regulations do not permit the officer so promoted to assume the higher rank **until released from active duty.**

In a related recommendation, the committee agreed that an officer **should not be recalled** in a higher grade than that he previously held on active duty **until at least a year has elapsed** since his release. An exception could be made, however, if it were in the best interest of the Air Force.

The committee also recommended that a **study be made of the assignment and utilization of Section 265 officers** serving within the major USAF commands. Some commands, it noted, use the 265 officer in the same way they would **any other active-duty officer,** limiting his activities to the functions of the office to which he is assigned. Other commands use him as the **principal adviser to the commander and his staff,** responsible for advising the commander on all matters pertaining to the Reserve forces.

The committee's **fifth recommendation** requested that the Air Staff **review drill pay requirements for general officers** serving as mobilization assistants to major commanders. Regulations authorize **forty-eight drills only** for those mobilization assistants on flying status.

—Official IANG photo

Brig. Gen Allison Maxwell, Air National Guard, of Indianapolis, has been named to a three-year term as a member of the Reserve Forces Policy Board. General Maxwell succeeds Brig. Gen. Philip P. Ardery, ANG, of Louisville. General Maxwell served in the European Theater during World War II and was recalled to active duty during the Korean War. He has been Chief of Staff of the Indiana Air Guard for the past five years.

ANG Commanders' Conference

More than a thousand Air Guard and Air Force officers checked in at **Ellington AFB, Tex.,** April 20-21 for the **Air National Guard's Annual Commanders' Conference.** Representatives of **three major USAF commands—ADC, TAC, and MATS**—were there as active participants, having assumed direct supervision of Air Guard operations and training last summer.

Maj. Gen. Perry B. Griffith, USAF's Deputy Inspector General for Safety, from Norton AFB, Calif., commended Air Guardsmen for their **excellent flying safety record** in 1960, when the Guard achieved its **all-time low of 9.3 accidents per 100,000 flying hours.** But he noted that the Guard's accident rate so far in 1961 is running **well above** 1960's, and he urged more thorough supervision over every aspect of flying. He offered the **full support of his safety team** in helping Guard commanders to find and correct weaknesses in their programs.

Maj. Gen. Winston P. Wilson, Air Guard Chief, led members of his staff from the National Guard Bureau in discussing programs and funds for the coming fiscal year.

"Fiscal 1961 will be remembered as the **year of major change in the Air National Guard,** not only in aircraft conversions but equally the change in concept to a ready force," he said. "I think fiscal 1962 is the year of progress **—progress into a balanced force.** Fiscal 1963 will see us **attain the objective of a fully trained and completely adequate combat-ready capability** in the Air National Guard."

Highlighting the Guard's fine safety record for 1960, General Wilson presented **certificates to sixty-two** of the Guard's ninety-two flying squadrons for an accident-free year. Forty-one of the sixty-two received a **comparable award** last year for 1959.

(Continued on following page)

USAF flying safety plaques for the last half of 1960 were awarded to the **121st Tactical Fighter Squadron** of Washington, D. C., commanded by **Maj. Robert Railey,** and the **194th Fighter-Interceptor Squadron,** Fresno, Calif., which was commanded during the rating period by **Lt. Col. Milton R. Graham** and later by Maj. James A. Kilpatrick.

Conference host for the fourth straight year was the **147th Fighter Group,** Texas ANG, commanded by **Lt. Col. Bob Taylor.** He and his men did a superb job in every way.

Capsule Snaggers

Crews from two squadrons of the **Reserve's 434th Wing at Bakalar AFB, Ind.,** are now at Hickam AFB, Hawaii, learning the ropes in **capsule snatching** from USAF's **6594th Test Wing.**

—Official US Air Force Photo

Back in 1923, as a noncom in Oregon National Guard, USAF Maj. Gen. Chester E. McCarty did some fancy shooting. Now, 39 years later, USAF regulations permit wearing marksmanship awards, and the General receives the USAF Distinguished Rifleman Badge from USAF Gen. Curtis E. LeMay.

The 434th had been designated last November to take on a **space-capsule-catching mission,** the first for the Reserve Forces. Early in May a five-man crew from Bakalar and one from the Wing's 73d Squadron at Scott AFB, Ill., left for Hickam to train with USAF crews who have been successful in **aerial recovery of several Discoverer capsules.**

Included in each crew are an aircraft commander, pilot, navigator, winch operator, and crew chief.

It's expected that when they complete their training in July, each crew will fly home in one of the 6594th's **specially equipped C-119Js,** being turned over to the 434th as the USAF Wing converts to C-130s.

Alert Around the Clock

The Air National Guard will assume an **expanded role in US air defense** on July 1 when twenty-six squadrons go on **twenty-four-hour runway alert** seven days a week.

Since the Air Guard joined in the alert program in July 1954, about half its interceptor squadrons have served on runway alert at a time, the assignment being rotated among squadrons each six months. Of these, however, only about **six were on twenty-four-hour alert;** the remainder operated fourteen hours a day.

When the Air Force assigned an increased transport role to the Air Guard, resulting in a **decrease in interceptor squadrons** from forty-one in January 1960 to twenty-eight by June 20, 1962, ADC **offset the reduction** by increased reliance on the units destined to remain. With twenty-six squadrons on twenty-four-hour alert, ADC gets **fifty percent more coverage from the Air Guard** than under previous alert schedules.

Who's Got the Squadron

Two wings are in the running to become the **first all C-124 wing in the Air Force Reserve.**

The **442d, of Richards-Gebaur AFB, Mo.,** commanded by **Col. Charles Daily,** appears to be a cinch for the honor. All three of his squadrons—the **305th of Tinker AFB, Okla.,** and the **303d and 304th based at Richards-Gebaur,** have been scheduled for C-124s.

The competition for the 442d comes from **Col. Forrest Harsh and his 435th Wing at Homestead AFB, Fla.** Originally, only two of his squadrons were scheduled to acquire the Globemaster. But CONAC shuffled some squadrons around so that the 435th, too, will be made up entirely of C-124s. Colonel Harsh's command now includes the **76th Squadron at Homestead,** the **77th at Donaldson AFB, S. C.,** and a newcomer, the **78th at Barksdale AFB, La.**

However, Colonel Daily's **305th Squadron** at Tinker already has its quota of the big birds, and his **303d and 304th Squadrons** will get their four-engine planes by July 1, before Colonel Harsh's home squadron, **the 76th.**

A 'Most Stable' Pilot

The Air Guard pilot whose **F-100 loosed a Sidewinder** missile that struck down a **SAC B-52** early in April has been **completely absolved** by the thirty-six-man USAF team appointed to investigate the accident.

This was reported by **Maj. Gen. Perry B. Griffith,** Deputy Inspector General for Safety, before the ANG Commanders' Conference.

General Griffith's statement was supported by **Col. Kenneth E. Pletcher,** flight surgeon on his staff, who made a thorough psychiatric examination of **1st Lt. James W. Van Scyoc** after the accident.

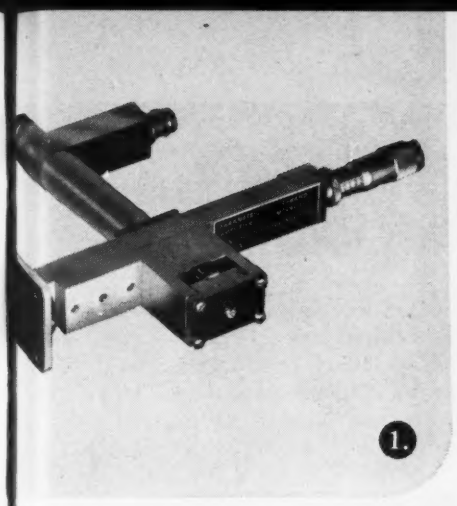
Colonel Pletcher termed Lieutenant Van Scyoc "one of the **most stable** pilots" he has ever studied. Under the circumstances of the practice intercept, Colonel Pletcher said Van Scyoc was "incapable" of firing the missile.

Official conclusions of the investigating board were:

- The GAR-8 missile was **not intentionally or inadvertently launched** as a result of **improper procedures** on the part of the F-100 pilot, Lt. James W. Van Scyoc.
- The GAR-8 firing was caused by a **freak "one-in-a-million"** malfunction when moisture seeped into an **electrical** circuit in the wing of the F-100 on which the missile was mounted. The moisture caused a **short circuit** between the aircraft's main electrical power line in the F-100 wing and the missile-firing circuit.
- All required **in-flight armament safety checks** had been completed by the F-100 pilot, Lieutenant Van Scyoc, who was found **fully qualified** to perform the mission in accordance with current USAF regulations.

To prevent the possible recurrence of the same or similar malfunction, the Air Force has **instituted the following actions:**

- The **electrical circuit is being modified** on F-100A aircraft. No further F-100A flights with GAR-8 missiles installed will be made until the new modification is tested and approved by the Air Force.
- **All other interceptor and fighter-type aircraft** and air-to-air and air-to-ground missiles in the USAF inventory are being **carefully analyzed.**—END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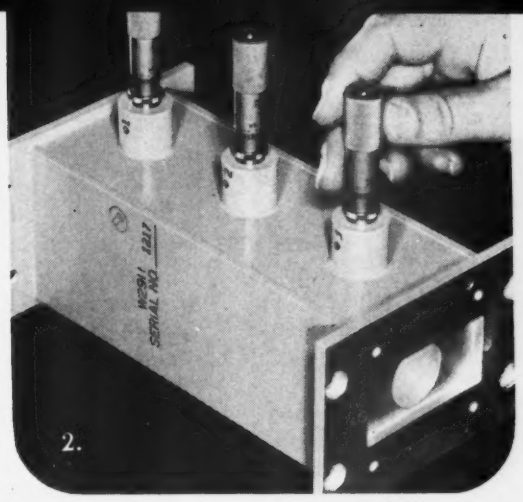
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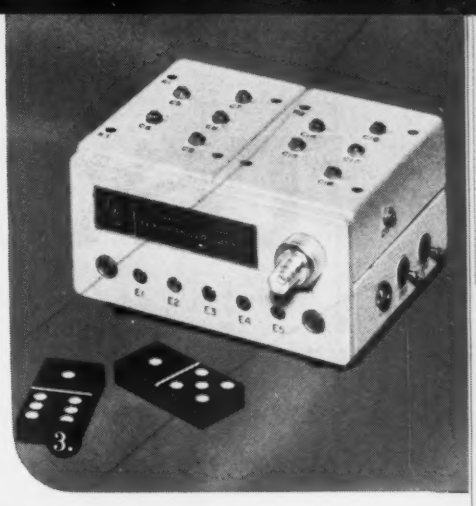
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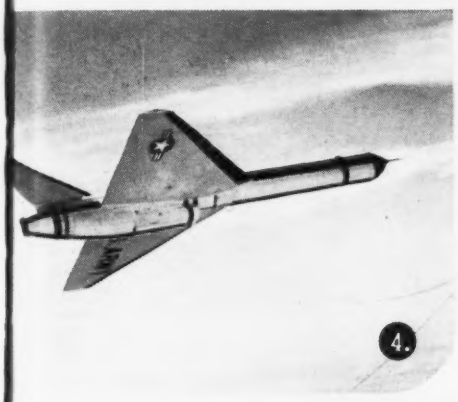
TI's RADAR CAPABILITY...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For systems requirements, Texas Instruments now offers major advancements in microwave techniques resulting from 15 years' experience in the development and production of radar equipment. Significant technological advancements include receiver front-end improvement through the following ...

1. Broadband parametric amplifiers — typical improvement in radar system noise figures possible with these devices ranges from 4 to 6 db. For comparable range improvement, using conventional techniques, it would be necessary to double antenna size or quadruple transmitter power.

2. Pre-selector filters — screen out interference from other radars.

3. Solid-state microwave sources — used as local oscillators or parametric amplifier pump sources ... these devices are crystal-controlled for high stability and can be used in any application requiring a stable, reliable signal source.

Examples of TI radar systems operational today include the following ...

4. Surveillance sensors for the U. S. Army Signal Corps AN/USD-5 combat drone, produced by Fairchild.

5. AN/APQ-86 reconnaissance radar in the U. S. Army Signal Corps L-23 aircraft.

6. AN/APS-80 radar and APA-125A indicator in U. S. Navy P3V ASW patrol aircraft.

7. Engagement displays for Nike-Zeus — the U. S. Army's anti-ICBM defense system, produced by Western Electric Company.

8. ASR-4 radar for Federal Aviation Agency controls airport traffic in congested areas. Display console gives clear indication of moving targets.

9. ASR-4 equipment cabinets typify system's design — all components uncover for easy servicing.

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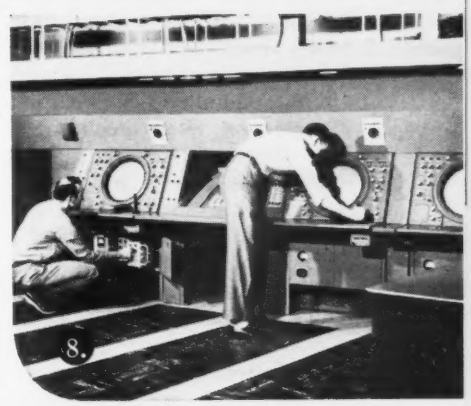
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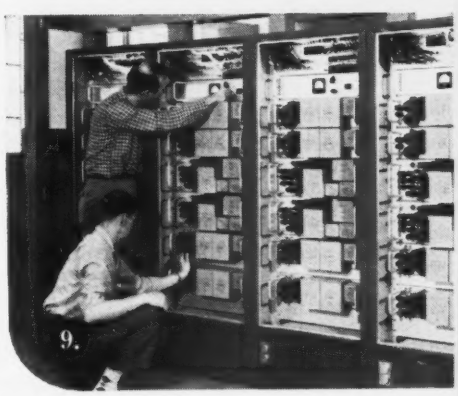
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APPARATUS DIVISION
PLANTS IN DALLAS
AND HOUSTON, TEXAS

TEXAS INSTRUMENTS
INCORPORATED
6000 LEMMON AVENUE
P. O. BOX 6015 DALLAS 22, TEXAS

TECH TALK

L. S. BUTZ, JR.

Project **Joshua,** the Air Force's **lightweight ICBM development program,** is under way at the **Rocket Test Agency of the Systems Command,** Space Systems Division, Edwards AFB, Calif.

Joshua is intended to have **great mobility** for an intercontinental missile. It will weigh **little more than a modern fighter** and could be launched from **trailer trucks or railroad trains.** Since this is the USAF's first **third-generation bombardment missile,** it is probable that time has caught up with predictions and this weapon also is being seriously **considered for use in spacecraft.** The upper stages of a very lightweight ICBM would seem to be ideal **to launch lifting warheads** from a space vehicle.

Aerospace Corp. is providing **systems engineering** on the project. The first contractor to be announced is **The Marquardt Corp.,** which is designing and manufacturing **full-scale and subscale fuel injectors** for use in engine development tests at Edwards. It is expected that these injectors will lead directly to lightweight flight units.

* * *

Boeing reports that the **Dyna-Soar wind-tunnel program** is the largest ever undertaken for any single project. About **thirty wind tunnels and shock tubes** are being used to gather data. This is **virtually every major wind-tunnel facility** still operating in the United States. Tunnel time is expected to total **twice that spent on the B-52** and about **three times that needed for the X-15.**

Main reason for the large program is that the Dyna-Soar will **fly in all four speed ranges**—subsonic, transonic, supersonic, and hypersonic. It also will have **more major configurations** than normal. These include: the **aircraft** alone, aircraft mounted on complete **Titan booster,** aircraft mounted on **Titan second stage,** aircraft slung **under the B-52** (for early unpowered drop tests), and the aircraft mounted on the **various Saturn stages.** Tests also will have to determine what **motions to expect** of the Dyna-Soar as it **separates from boosters and mother aircraft.**

In keeping with the unusual nature of the Dyna-Soar wind-tunnel program, there is **more than the usual uncertainty** surrounding the data coming from these tests. Since full-scale, man-carrying winged vehicles have never flown at **hypersonic speeds,** no one really knows whether wind tunnels present **a true picture** of how they will act. Some of the uncertainties are so serious that **another type of test will be conducted** to spot check the great mass of high-speed wind-tunnel information.

In these tests, **fairly large-scale models** of the Dyna-Soar will be fired to **near orbital speeds** by **Scout rockets.** Data on their behavior will be **telemetered to the ground.**

These models will be in the neighborhood of **twenty-five percent scale** and several times larger than any tested in a high-speed wind tunnel. Original plans call for **less than a dozen** of the large-scale model firings because they will cost over **$500,000 each.** It is hoped that this **small number of large rocket tests** will give a positive check on the validity of wind-tunnel data.

Two types of rocket models will be flown. One will be the customary **scaled-down replica of the Dyna-Soar's external shape** to get drag data, stability coefficients, and other aerodynamic information. The other type will be built around **full-scale sections of the Dyna-Soar's structure.** These models will be shaped to create the heating and pressure pattern expected on the structural sections during a **full-scale Dyna-Soar flight** at hypersonic speeds.

A **250,000-lb.-thrust conical, segmented, solid-propellant rocket motor** will be test fired late this summer by **United Technology Corp.,** a subsidiary of United Aircraft. This work will be covered by **National Aeronautics and Space Administration** contract and is a major element in the NASA program to develop a family of **large, low-cost booster rockets.**

Before the end of this year United plans to fire a **500,000-lb.-thrust engine** of the same type. The current goal is to build a single **three million-lb.-thrust segmented engine** that could be clustered to provide a **total booster thrust** of **fifteen million pounds.**

The 250,000-lb.-thrust engine to be fired in the summer is about **forty feet long,** has a maximum diameter of around ten feet, weighs over **75,000 lb.,** burns for **sixty seconds.**

Solid-propellant engine for NASA, producing 250,000 lb. of thrust is shown in front of United Technology offices. This rocket with a tapered case is the forerunner of larger rockets to be fired in a few months. The performance of these test engines will have a great influence on US decision to build or bypass large solid-fuel boosters for future space use.

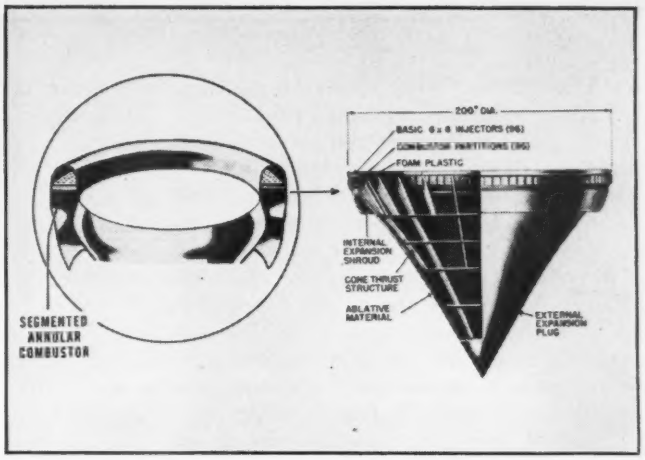
* * *

US research work on **unconventional rocket engines** has picked up markedly during the past year or so after **struggling along on low funds** during most of the 1950s.

One of the most active projects today involved **General Electric's plug-nozzle liquid-propellant concept** with **segmented combustion chambers.** The **50,000-lb.-thrust engine** shown firing was constructed by GE to fulfill one portion of a **contract with NASA.** The principal objective of the NASA-GE program is to make a **major reduction in the time and cost of developing large, liquid-propellant rockets.**

The segmented combustion chamber is the **key to achieving this objective.** A large percentage of chemical rocket development money is spent on **preventing combustion instability.** Most instability problems are due to the **large size** of high-thrust engines. The segmented combustion chamber avoids them because **its dimensions are small.**

The philosophy behind GE's segmented annular combustor has been expressed as follows by **Kurt Berman,** who



Experimental General Electric plug-nozzle rocket engine producing 50,000 pounds of thrust is shown at left. Eight separate combustion chambers are exhausting against the center plug. Very large advanced design engine above with almost 100 small combustion chambers is being studied.

heads the work. He says, "After more than twenty-five years' experience with conventional engine designs, we are still plagued with **combustion instability** and are still unable to predict, even for well developed engines, what the **operational characteristics** will be even under rather minor deviations from the design point. A given developed conventional rocket combustor design does not serve as a model or a sample for a new unit to be developed. A **new 'cut and try'** program is required, necessitating a costly and lengthy program."

The segments of the annular combustor ". . . can be designed of **such small dimensions** that combustion instability can be **successfully suppressed** as has been shown experimentally. In addition, each combustor segment can **serve as a model** or sample of the complete combustor unit and **provide the tools** to establish the combustion characteristics very quickly and cheaply."

Also, the annular combustion chamber **does not have to be heavier** than a conventional cylindrical combustion chamber, as was pointed out in the article on space engines in the March issue of AIR FORCE, and as has been suggested by some rocket specialists. On this point Mr. Berman says, "Our chamber designs . . . do not use a complete annular combustor, *i.e.*, one in which the hoop stresses would be taken over a large diameter. Therefore, the plug-nozzle configuration **does not become excessively heavy.** As a matter of fact, it is indicated that they can be considerably lighter than conventional engine configurations."

Other advantages of the segmented-chamber, plug-nozzle rocket include: **simple thrust vector control** by changing the combustion pressure in a portion of the chambers; and **low weight for the structure needed** to carry the thrust load into the vehicle the engine is pushing.

* * *

Subcontract for the **air-pumping system** in the **USAF-Northrop laminar-flow control experimental aircraft** has been awarded to the **AiResearch Manufacturing Division** of the Garrett Corp. This pumping system may be carried either **in wing pods or in the fuselage.** It will draw the low-energy boundary-layer air on the aircraft's wings through **paper-thin slots** in the skin. If this works as well as tests indicate, the **skin friction and pressure drag** of the wing will be **reduced almost to zero.** Fuel consumption would **drop** and normal range be **greatly** increased.

Northrop will modify two **Douglas B-66** aircraft to use the pumping systems. The first of these is due to fly **in about eighteen months.** This program is the culmination of **more than ten years of work** at Northrop under the technical direction of Dr. W. Pfenninger.

* * *

Royal Air Force crews manning the **Thor IRBM** bases in England have conducted **sixteen combat training launches** from Vandenberg AFB, Calif. **Fourteen** of these have been successful.

* * *

Air Force has awarded an **$86,000 study contract** to the **French firm, Nord-Aviation,** to determine the operating characteristics of a particular family of **turboramjet engines.** Top speed of these engines will be **above Mach 2.5** Nord has conducted research on turboramjets for more than ten years.

The **Nord Griffon II,** only aircraft known to be flying in the world with this type of powerplant, has exceeded **1,440 mph (Mach 2.19)** at 50,000 ft.

* * *

Bumpy, **uneven runways** may cause the heaviest loads that some parts of **big supersonic aircraft have** to withstand. Very long aircraft, such as the B-70 in which the pilot will sit **more than seventy-five feet ahead of the nose gear,** present some unusual structural problems during landing, takeoff, and taxiing.

It is possible during the **high-speed ground run** of such aircraft for the nose wheel to bounce rather easily and still create **high angular accelerations** as the nose rides up and down. The loads from these accelerations **can exceed the maximum flight loads** in some cases. If this happens the **structural weight has to be increased** just to run along the ground without damage.

A new survey is being made to determine the **bumpiness of the average runway.** The **Midwest Research Institute** is surveying runways at **twenty-three Air Force bases** under a contract awarded by the **Aeronautical Systems Division** of the Systems Command. Using a new method, it will be possible to check each airfield **in five days compared to six months required in the past.** Key equipment in the new method are **two trailers carrying photoelectric cells.** They

(Continued on following page)

can measure the "bounce" of a **horizontal light beam** as they are towed together down a runway. The data is stored rapidly and can be **analyzed** on a computer to give the height variations on the runway.

It is expected that ground run structural loads can be predicted **much more accurately** using this new information.

* * *

New **simulators** to train **defense officers for the Convair B-58** are being delivered to the Strategic Air Command. The equipment, manufactured by **Reflectone Electronics, Inc.,** provides the most realistic electronics countermeasures training now available. **Fifty different conditions** can be simulated from multiple attacks by enemy aircraft and missiles through simple detection by ground radar. The hostile weapons will "follow" the B-58 **through maneuvers** unless they are **"destroyed" by the aircraft's rear-firing armament or "diverted"** either by positive ECM action or by "chaff" strewn out by small rockets. A single program may be presented to a **large number of students** to measure relative proficiency. Or the instructor operating the simulator may vary **the problems at will** to offer an almost endlessly varying sequence of events.

Average stint in the defense officer trainer (*see cut*) is about six hours with all phases of a mission being simulated. It may **be used independently** or in conjunction with pilot and navigator units for **complete aircrew training.**

* * *

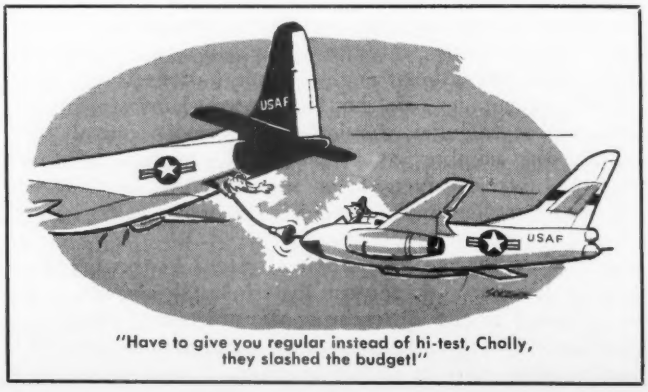
The military's use of **computer-operated simulators** for realistic **war gaming and training for complex manual tasks** has stimulated a growing interest in business games.

About **thirty universities and large corporations** are using two complex management simulation games created by the **Univac Division of Sperry Rand Corp.** One of the games presents the situations faced by the **marketing managers** of a large business. The other involves **manufacturing.**

Defense officer cockpit on the Convair B-58 is duplicated above in the training simulator built by Reflectone Electronics. Simulated flights up to ten hours long with intermittent periods of "combat" action are handled by SAC crewmen. The defense officer handles the aircraft's rear-firing armament, the launching of "chaff" rockets, and the ECM gear which is made by Sylvania Electric Products, Inc.

In each of them the "managers" playing the game are given certain **resources and responsibilities** in the management framework. A computer is programed to present them with certain problems. These include: **what to pay** salesmen, **how to distribute** the sales staff, **how and when to train** personnel, **what to spend** for advertising and sales promotion, **when to order** production, **where to stock** inventory, the **size of inventories,** raw material **purchases, quality control, shipping,** etc. The course of the game varies almost infinitely depending upon the answers given the machine. After a period of time the computer determines whether the simulated companies **have made or lost money** and have satisfied other objectives set down at the beginning of the game by the "board of directors."

These are highly sophisticated games that are being used with enthusiasm by groups at the **Harvard Business School, the Universities of Pennsylvania and Chicago, and other management authorities.** Currently the games show one notable divergence from reality, however. When a problem is presented, **some action must be taken to solve it.** The game won't rock along if any "manager" temporarily won't manage.—END



"Have to give you regular instead of hi-test, Cholly, they slashed the budget!"

HI-POWER ELECTRONICS

Radar Transmitter FPS-35

For the security of our nation

The AN/FPS-35 Radar Search Set is an integral part of America's security defense network. This massive sentinel stands in vital areas protecting the nation.

FXR is the designer and developer of the Line Modulator, the key block in the transmitter complex. High level engineering combined with complete precision facilities produced the answers to the unique problems encountered.

Solutions to the most exacting specifications are the foundation of FXR's service in High Power Electronics. The solution to your particular problem is but a phone call away. Just call and ask for an FXR applications engineer to discuss your needs.

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Checking performance of a nitrogen tetroxide OLFACTRON (center unit): Dr. R. R. Austin (right), with Mr. D. S. Barlow, Vice President (left), and Mr. L. M. Ballard (center) of the Instrument Division.

A Report from American Systems Incorporated...

Exotic Propellant Vapor Detection

As a major step in its program of developments for the aerospace field, American Systems Incorporated is introducing a new type of instrument for detection of toxic propellant vapors. Called OLFACTRONS because they act like an electrochemical "nose," quantitatively measuring vapors in amounts too slight to be detected by human senses, these instruments increase safety and effectiveness in handling high-energy propellants.

In the OLFACTRON principle, the vapor sensed produces a proportional electric current, which in turn is indicated on a meter, or recorded. The instruments are fast-acting, and can be integrated easily into electronic warning systems. OLFACTRONS are now available for detection of hydrazine, UDMH, nitrogen tetroxide, and borane. Similar instruments for detection of sulfur, hydrocarbons, and moisture are in production for the natural gas, LP gas, petrochemical, and chemical industries.

Developed by Dr. Robert R. Austin and Myron L. Robinson, in association with the Instrument Division of American Systems, OLFACTRONS illustrate the systems influence in practical instrumentation design. The instruments are adaptable to system networks involving communications, computation, and data processing.

Complementing the work of the Instrument Division, technical programs are under way in six other Divisions:

INFORMATION SCIENCES
Mathematical and statistical research; computer programming, and advanced programming systems; computation services; digital system studies; logical design; advanced systems analysis.

DATA PROCESSING
Data processing subsystems research and development; logic of command and control complexes; optical recognition systems.

ELECTROMAGNETIC SYSTEMS
Electromagnetic physics; electronic and mechanical scanning antenna systems; development and manufacturing of complete sensor systems and special microwave components.

RESEARCH LABORATORIES
Solid state physics and systems; magnetic thin-film research and subsystems; advanced components for information processing.

COMPONENT DEVELOPMENT
Advanced component technology; materials and processes; computer component development; chemical deposition of magnetic surfaces on drums, disks, rods.

AUDIO-VISUAL
Audio-visual (INSTRUCTRON) devices for assembly line and instructional applications; production of work stations designed on human factors principles.

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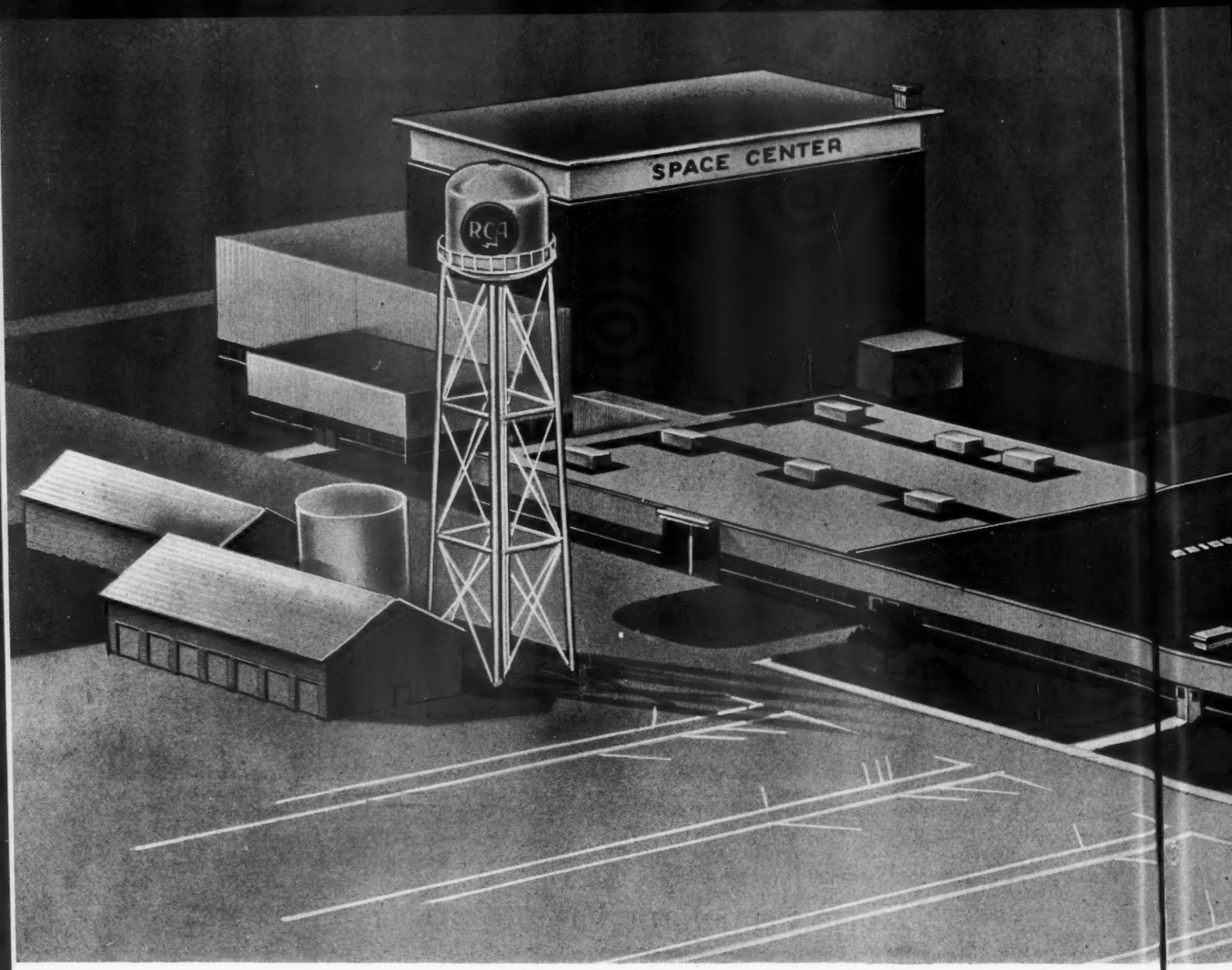


New RCA Space Environment Facility Brings Outer Space Down to Earth...

...Will pretest coming generations of U.S. space vehicles and satellites at environmental extremes assuring reliable long life operation and optimum performance.

RCA expands its proved capability to meet the challenges of space-age technology with the construction of an advanced space environment center at Princeton, N. J. Here, today's *and* tomorrow's space vehicles and satellites can undergo a new degree of intensive and thorough testing prior to "launch" to achieve greater reliability in space.

Included in the new environmental equipment and facilities being built and installed at the RCA Space Center are the following advanced testing devices:

Vacuum-Thermal Chamber—measuring 28 feet in diameter and 25 feet high to accommodate the coming generations of space vehicles and satellites and meet all vacuum-thermal requirements.

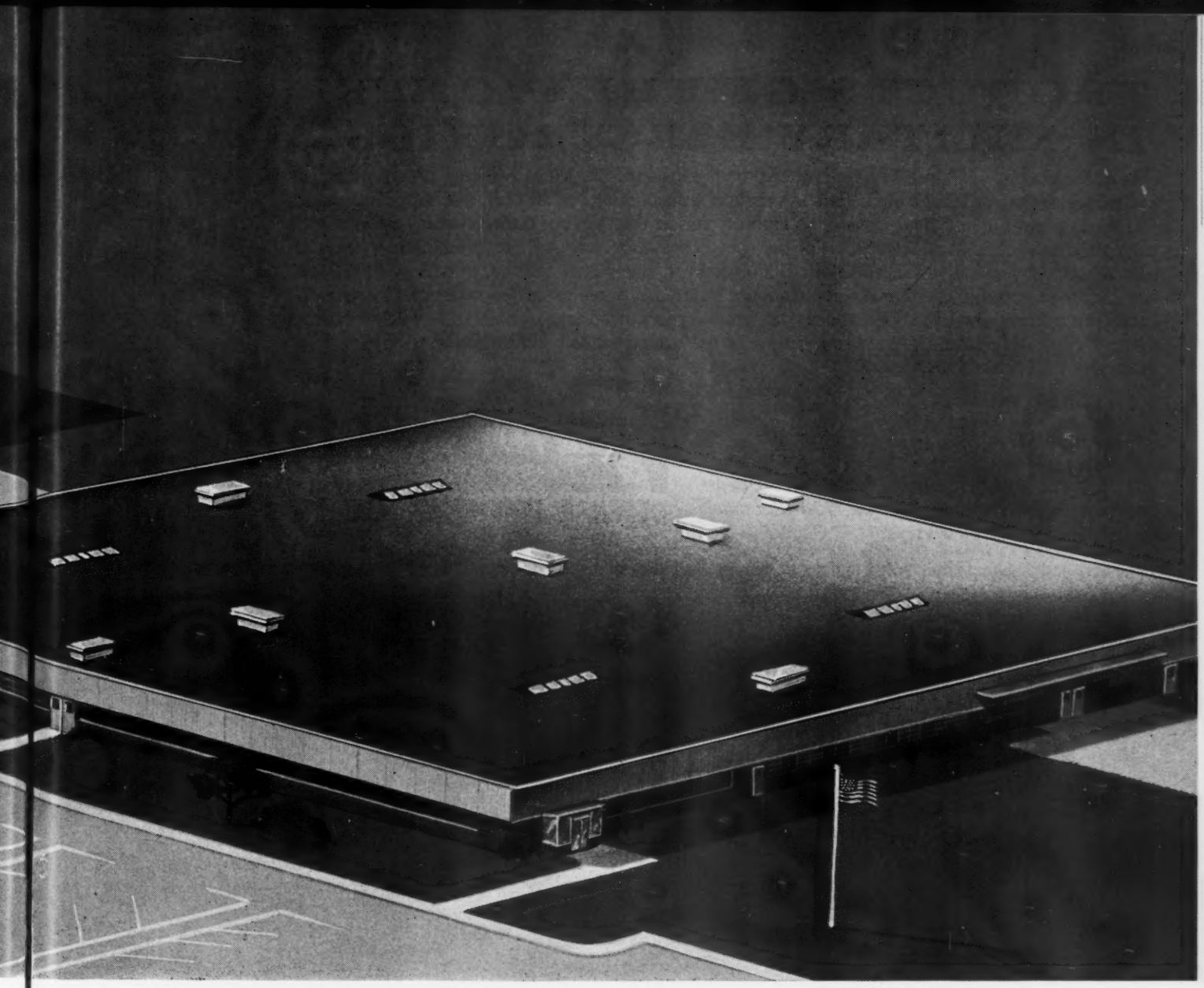
Vibration System—provides 28,000 pounds peak force for sinusoidal, and 28,000-pound rms force for random motion testing.

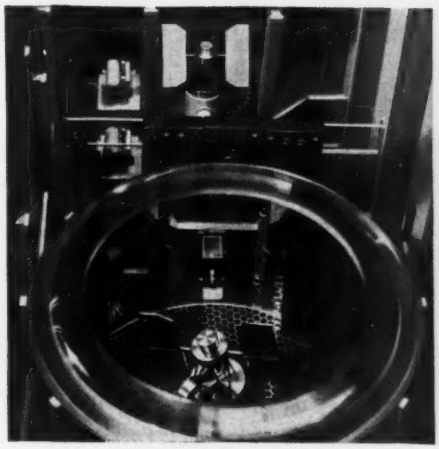
Temperature-Humidity Chamber—so versatile it can create virtually any thermal-humidity condition desired. Temperatures may be varied from —50° F to 250° F; humidity from nil to maximum.

Rotary Accelerator—subjects subsystems of space vehicles and satellites to forces as high as 2500 g lbs.

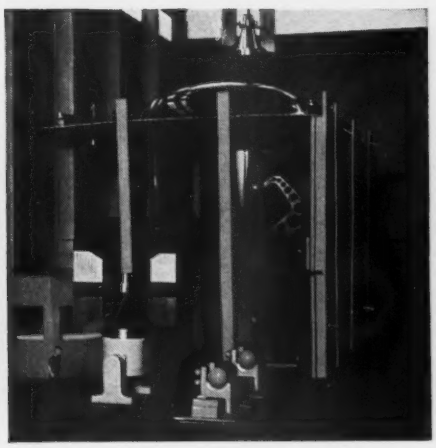
The entire RCA Space Center, which contributed to the success of projects such as SCORE, TIROS I, TIROS II and ECHO I, continues to be dedicated to the conception, development and production of earth satellites, space vehicles and ground support and information handling equipment. For additional information about RCA's engineering talents and proved capabilities, contact the Manager, Marketing, RCA Space Center, Box 800, Princeton, N. J. And, for a complete description of the new environmental facilities, write for your copy of the brochure "RCA Space Environment Center."

If you are interested in participating in the challenging opportunities that exist at the RCA Space Center, contact the Employment Manager, Astro-Electronics Division, Defense Electronic Products, Princeton, N. J. All qualified applicants are considered regardless of race, creed, color or national origin.

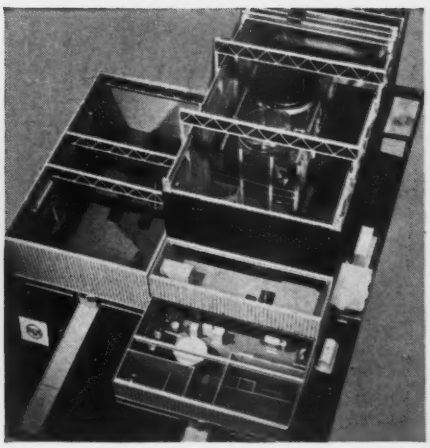




New advanced Vacuum-Thermal facility shown in model has pumping system that can reduce pressure to 5 x 10^{-6} mm Hg within 24 hours with a 3500-pound payload in the enclosure.



New Vibration System will include 28,000-pound exciter driven by an amplifier capable of delivering 140 KW over a frequency range of 25 to 10,000 cps.



All existing environmental equipment will be housed here and a new high-bay assembly area provides facilities for assembly of an increased number of space systems.

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PRODUCTS OF THE PIONEER IN MILITARY ELECTRONICS...

As a department of Fairchild's Defense Products Division, Du Mont Military Electronics provides acknowledged leadership in data acquisition, transmission and display, and support systems. These Du Mont talents have developed high resolution electronic imaging systems operating in the visual and near infrared portion of the spectrum, and from daylight illumination levels to overcast moonless nights. Electro-visual fire control, radar boresighting, missile guidance and space reconnaissance are typical applications. Millimeter wave radar for navigation, detection, tracking and ranging of surface and air targets is a specialized area of outstanding achievement. Rapid go-no-go electronic test equipment also has been designed and produced for operational check-out of missile, drone and aircraft systems.

Whatever the environment or the requirement—the Du Mont Department offers over 25 years of experience as the pioneer in military electronics. *For information or specifications, write the Marketing Manager, Du Mont Military Electronics Department, Defense Products Division, 750 Bloomfield Avenue, Clifton, New Jersey.*

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AFA NEWS

SQUADRON OF THE MONTH

Squadrons of the Utah Wing, Cited for
extremely successful and effective programing in the sponsorship of the 1961 Aerospace Education Symposium, held recently in Ogden.

The **Aerospace Education Symposium,** an annual event sponsored by **AFA's Utah Wing,** continues to improve each year. The 1961 event was the fifth Symposium, and the second which dealt **primarily with education interests in the Rocky Mountain area.** Some 350 educators and education administrators were guests of the Wing at Ogden's Hotel Ben Lomond on February 17-18, along with representatives of every aerospace industry in the area. **Joseph C. Jacobs,** Wing Commander, was in charge of arrangements, while the program was under the very able guidance of **Ogden Squadron Commander Robert P. Stewart.**

The Symposium began at **Hill AFB,** where the guests were given a **briefing on the Minuteman ICBM,** plus a tour of **Ogden Air Materiel Area Headquarters.** They then attended the kick-off banquet at the hotel and were addressed by **Col. Harry L. Evans,** Commander for Space Systems, USAF Ballistic Missile Division. **John R. Alison,** former AFA President and Board Chairman, served as Toastmaster for the dinner, which was cohosted by **Boeing Co., Aerojet-General Corp., Hercules Powder Co., Thiokol Chemical Corp., Litton Industries, Inc., and Sperry-Utah Engineering Labs.** Following the banquet, and the next morning, the educators were briefed by representatives from the above firms, plus **Northrop Corp., Marquardt Corp., International Business Machines, and Western Design & Electronics Co.** Moderator for the evening, as well as the program next morning, was **Ray O. Mertes,** Director of School and College Services, United Air Lines.

On Saturday morning, a breakfast was sponsored by **Otis Elevator Company's Defense & Industrial Division** for the educators and other AFA guests. At noon the Forecast Luncheon was held, with **Lt. Gen. James E. Briggs** delivering the address. He is Commander, Air Training Command, with headquarters at Randolph AFB, Tex. **Bernard R. Diamond,** Manager of Ogden's Chamber of Commerce, served as Toastmaster for the luncheon which was cohosted by the same firms that sponsored the Friday dinner.

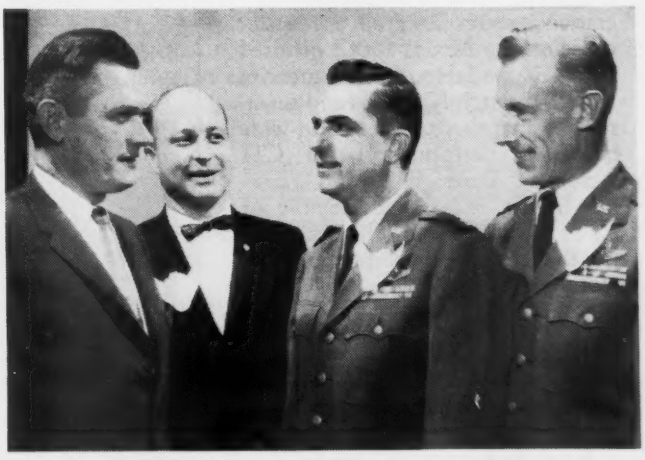
Outstanding support was lent to the program by many AFA members in Utah, and it is always dangerous to list only a few; however, those who were most in evidence included **Dale R. Erickson,** former Regional Vice President; **Karl Caldwell,** current Vice President; **Lee Florence,** Wing Treasurer; **Keith Nichols,** Wing Vice Commander; **Bob McArthur,** Salt Lake Squadron Commander; **Lou Bonomo,** Ute Squadron Commander; and **Ray Yates,** a member of the Wing. A great many others contributed to the success of this fine program, including **Maj. Gen. Kenneth B. Hobson,** Commander, Ogden AMA, and the Deputy Commander, **Col. Victor L. Anderson.**

It has become almost routine for the Utah Wing to stage outstanding events in an effective and professional manner. The 1961 Aerospace Education Symposium **unquestionably deserves ranking among the best AFA**

(Continued on following page)

Col. Harry Evans and Utah Wing Commander Joe Jacobs discuss a model of the Titan ICBM on display during the Wing's Aerospace Education Symposium held in Ogden *(see text).*

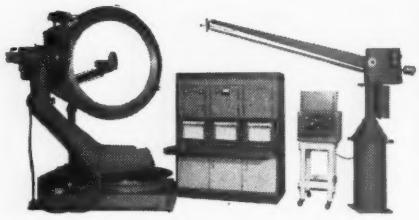
National Director Jim Snapp, Jr., Ray Stauffer, and Mrs. Muriel Tolle are shown with some of the awards that have been garnered by the San Diego Squadron. At the recent Wing Convention, San Diego received the Squadron of the Year trophy, the fifth time the unit has been so honored.



Douglas Deal, Squadron Commander, A. A. West, National Director, and Tactical Air Command's Captains Ernest P. Couture and Robert J. Spence are shown at recent Syracuse, N. Y., Squadron event when Squadron members and guests received briefing on Command's Composite Air Strike Force.

Boresight Accuracy

Tested Automatically



- Tests Type I and Type II to MIL-R-7705A(ASG)
- Automatically records boresight error, percent transmission, antenna patterns
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- Test and align doppler antenna systems
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The effectiveness of the finest radar tracking system can be destroyed by the variations in refraction of the radar beam as it passes through the plastic radome. The CTI Automatic Radome Boresight-Error Measuring System assures fast, accurate measurement of the radar beam deflection as a continuous function of the antenna position. Three recorders plot the magnitudes of the horizontal and vertical error components, plus the total vector sum of the beam deflection angle, directly in milliradians. Rate of change of beam deflection angle, essential to fire control and missile applications, is readily available from the recordings. Percent transmission through the radome is measured and recorded directly. Antenna patterns are plotted with, or without, radomes. This high accuracy continuous automatic testing detects discontinuities overlooked by manual methods. The complete operation is controlled from the master console. The Model 150C, pictured here, is available for frequencies from S through K_a bands and infrared. With five years of world-wide proof of performance, the CTI Automatic Boresight-Error Measuring System is another example of CTI's advanced leadership in meeting the needs of modern electronics technology.

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AFA NEWS — CONTINUED

Right, LA Group Commander Ron McDonald accepts "Man of the Year" trophy during California Wing Convention held in Las Vegas. Seated at table are guest speaker Gen. Orvil Anderson, Toastmaster Arthur F. Kelly, and AFA President Tom Stack. Standing behind the table is the retiring Wing Commander, John L. Beringer, Jr., who presented the awards.

At left Janet Austin, Lucille Redtfeldt, and Ernestine Sullivan are shown with a portion of the exhibit developed by the members of San Fernando, Calif., Auxiliary Unit for display in area schools. Exhibit has been placed in dozens of Southern California schools, along with AFA materials and brochures describing the aerospace careers available to students.

programs of the year, and will no doubt have a continuing impact on the community leaders of Utah. We proudly name the Squadrons of the Utah Wing to receive the **Squadron of the Month award.**

* * *

CROSS COUNTRY . . . Massachusetts Wing Convention will be held in Boston on June 24-25. For details contact **Steve Tetlow,** Box 423, Taunton. . . . AFA's **Awards Committee** will meet soon to consider **nominees for 1961 awards.** If you have any suggestions send them to the Committee at Headquarters. . . . Three **new Squadrons** have been chartered in the past thirty days: **Mansfield, Ohio; Brigham City, Utah; and Tri-County, N. J.** . . . AFA's "junior affiliate," **Arnold Air Society,** has voted to hold its national conclaves in **conjunction with Air Force Association's National Conventions,** beginning with the 1961 event in Philadelphia. . . . **Lt. William Simon,** serving a tour at Castle AFB, has been elected President of the newly formed **Arnold Air Society Alumni Association,** AFA's newest Division. Administrative Headquarters for the Division have been established **in Pittsburgh.** . . . AFA's **Honor Squadron Trophy,** top organizational award at the **Air Force Academy,** will be presented at the annual Wing Review on June 3, with **AFA's Board of Directors and Wing Commanders** in attendance as honored guests. This is the third year award has been made. —Gus Duda

MATS Command briefing is given officers of St. Louis Squadron by Col. Ray Towne, Information Director. Squadron receives excellent cooperation from Command Headquarters at Scott AFB in keeping AFA members abreast of mission.

USAF on Film

These and other selected USAF films are available for loan from the Air Force Film Library Center, 8900 S. Broadway, St. Louis 25, Mo. Requests, which are welcome from both military and civilian groups, should contain Air Force serial numbers and correct titles to avoid delay in processing. Because of heavy demands for certain films, particularly those on missiles and space, the Film Library Center recommends that requests indicate both alternate films and showing dates.

AFNR 60—Air Force News Review Number 60—Missile activity at Cape Canaveral; General Twining retires; men spend month in simulated spacecabin; Tinker Terminal automated; Harlingen AFB, Tex., trains aerospace navigators; golfers compete at Randolph AFB, Tex.; and U-2 flies sampling missions. 14 min., black and white.

AFNR 61—Air Force News Review Number 61—Highlights 1960—Features following USAF accomplishments: X-15 reaches record 136,500 feet; Capt. Joseph Kittinger bails out of gondola at 102,800 feet; Discoverer XIV capsule recovered in midair; SAC holds bombing, refueling, navigation, electronics countermeasures competition; TAC holds bomb-strike exercise (Mobile Yoke); MATS hauls record lift of troops and cargo to Puerto Rico; Air Force Falcons have first gridiron meeting with Navy; Minuteman mobile train makes test run; U-2 flies high-altitude sampling mission; Atlas makes record flight of 9,000 miles. 26 min., color.

SFP 626—Alert in the Pacific—A penetrating look at vital work being accomplished by the Pacific Air Forces to meet the Red threat in the Far East, with commentary by newsman Walter Cronkite. 15 min., color.

SFP 1044—Checkmate—Demonstrates how the Tactical Air Command puts operation "Checkmate" into action with speedy deployment of a Composite Air Strike Force to an overseas area to support a friendly nation threatened by aggression. 29 min., color.

SFP 1036—Ballistic Missile and Space Program—Illustrates how ballistic missile and space program goes steadily forward, from concept to operation of hardware. 23 min., color.

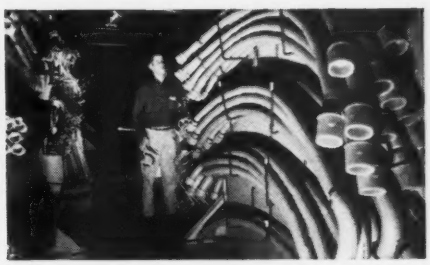
SFP 1049—Skywatch—Men, missiles, and manned bombers stand alert and ready for destructive retaliation against aggression. Features a B-52 missile bomber on a practice run from Travis AFB, Calif. 28 min., color.

SFP 1017—Materiel Handling Principles in Transportation—Illustrates the right and wrong ways to handle military cargo. 20 min., black and white.

TF 1-5350—Air Traffic Control Procedures—Describes VORTAC and TACAN preflight, in-flight, arrival, departure procedures; explains air traffic control responsibilities of pilot and controller; points out the growing complexity of air traffic problems. Illustrates close teamwork between pilot and controller. 30 min., black and white.—END

Boeing saves manhours, expedites parts requisitioning with Electrowriter® Systems

When key production or field areas at Boeing's Transport Division urgently need parts, they request them by writing directly on Electrowriter Transmitters to . . .



. . . remote parts stores. Here, written requests are instantly recorded as the sender writes. Stock clerks take Electrowriter messages, quickly fill orders.

Electrowriter Systems have streamlined special parts requisitioning for the Transport Division of Boeing Airplane Company at Renton and Seattle, Washington. Formerly, urgent parts requests were handled by messenger, telephone, or squawk box. Now, with Electrowriter substantial savings in manhours are effected on the production lines and in parts stores. The savings pay for the Electrowriter Systems many times over. There are no more verbal mixups or delays. Immediate transmission of written requisitions speeds receipt of parts and provides permanent records which pinpoint responsibilities. At the parts stores Electrowriter receives questions completely unattended, releasing personnel for order filing.

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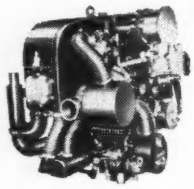
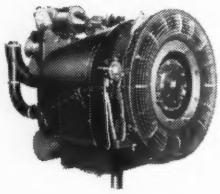
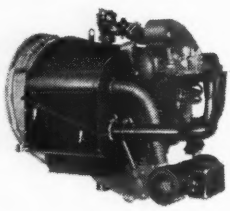
CONTINENTAL PACKETTE POWER *USE-PROVED* Round the Globe



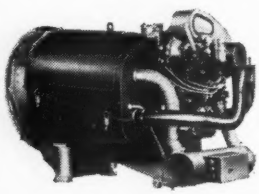
PC-30
2-cyl. 34 hp.



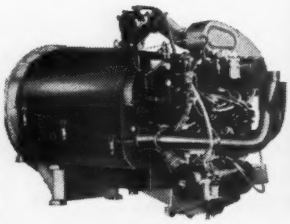
PC-60
4-cyl. 70 h.p.



PE-90
4-cyl. 110 hp.



PE-150
6-cyl. 175 hp.



PE-200
8-cyl. 250 hp.

Ground support equipment built around Packette power is proving itself today on defense installations all over the free world.

Developed by Continental Motors, with the famous Continental air-cooled aircraft engines as their basis, these five Military Standard models [Mil. E-26248 (USAF)] range from 30 to 250 hp, combine compactness and light weight with ease of servicing and upkeep, and operate at any temperature from equatorial heat to polar cold. Of special interest and importance, as simplifying maintenance in the field, is the wide interchangeability of parts among the several Packettes, and between them and the models in the Continental aircraft engine line.

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airman's bookshelf

Symposium on Strategy

***American Strategy for the Nuclear Age*, Walter F. Hahn and John C. Neff, Editors (Anchor Books, Doubleday, 1960, 455 pp., paperback edition, $1.45)**

Reviewed by Col. Edward M. Collins, USAF

Few readers of AIR FORCE/SPACE DIGEST would forego an opportunity to attend a symposium on American strategy which included speakers such as John Von Neumann, J. Edgar Hoover, Henry Kissinger, Walt Rostow, Dean Acheson, David Sarnoff, Hanson Baldwin, Stefan Possony, John F. Loosbrock, Herman Kahn, Bertram Wolfe, and others of like quality. In *American Strategy for the Nuclear Age*, the editors have presented such a symposium in the form of lectures which these authorities gave at the first National Strategy Seminar for Reserve officers at the National War College in July 1959. They have added writings, published elsewhere, of authorities who did not lecture at the seminar.

As Clausewitz stressed in *On War* and elsewhere, hard as we try, warfare cannot be reduced to a set of eternal, easily understood rules or principles which can be put together like a cook-book recipe. On the contrary, an understanding of war comes only from much study, reflection, and —through peacetime simulation or actual war—practice. Moreover, he who would understand war must also understand that each epoch produces its own kind of war. The social, political, technological, and economic facts of an era are given expression in a form of war which can only exist in those conditions.

Clausewitz saw this clearly in the age of revolution, social upheaval, and war in which he lived. *American Strategy in the Nuclear Age*, with its broad range of strategic views and discussion, puts us back on the road to similar understanding.

Our own age has its own peculiar and unique form of war, resulting from world conditions and the nature of communism. Since this kind of war is waged continuously and unrelentingly by the Communists, it follows that the American response must recognize this activity for what it is. Appropriate and urgent measures must be taken to overcome the forty-year lag in our thinking on the nature of war, and to develop a doctrine which is realistically suited to current conditions. The military has its part to play in such a doctrine, and it is a large part, as the book rightly brings out. However, the problem is not, as some have suggested, that the military aspects of the struggle have been overstressed, but rather that the other aspects have been insufficiently appreciated and developed. Measures to remedy these deficiencies are suggested.

The whole history of the human race establishes that dangers, once adequately understood, can be overcome by combining understanding with exertion. Napoleon swept all before him and paralyzed Europe with fear by introducing a new system of warfare, but when his victims, actual and prospective, grasped his method and found the moral resources to resist him, Napoleon's ambitions terminated in the solitude of St. Helena. The modern heirs to Napoleon's mantle of world conqueror, who would similarly combine the political and military methods of conquest, will be similarly thwarted if their prospective victims resolve to understand and defeat their methods of waging total war under the guise of peace.

ABOUT THE REVIEWER: *Colonel Collins is Chief, Special Advisory Group, ACS/Intelligence, Hq. USAF.*

Action over England

***The Sky Suspended*, by Drew Middleton (Longmans, Green & Co., 1960, 277 pp., $4.50)**

***Strike from the Sky*, by Alexander McKee (Little, Brown & Co., 1961, 288 pp., $4.75)**

Reviewed by Claude Witze

When the Battle of Britain is a hundred years old, like our own Civil War, the buffs will have good source material. They will be able to recreate some of the skirmishes with help from Alexander McKee's account, drawn from his own diaries and detailed interviews with the participants. The stuff is complete; the dialogue is there, specifics on the equipment and charts showing how the formations were developed for fighter sorties and the bombing missions. And this is not done for the RAF alone. McKee's attention is equally meticulous in his reports on what the Germans were doing, what they said to each other, and how they felt about such things as Hitler's intuition.

Drew Middleton's book is the account of the ground observer. At the time, twenty years ago, he was a reporter in London for the Associated Press. Now chief correspondent there for the New York *Times*, his story is just as dramatic as Mr. McKee's, but it is less concerned with the machinery of air war itself. For the casual reader, who may not care to take himself into the cockpit and roar over the channel, this is better reading, sprinkled with the kind of word pictures and incidents that point up the courage of the British people and their defenders.

Recounting this history was prompted by the twentieth anniversary of the Battle of Britain. There is some difference of opinion about which events started the Battle and brought it to an end, but it is safe to say lines were drawn in the summer of 1940. The British say it was over in the following October, but the Germans hold it lasted until they moved against the Russians in June of 1941. The important thing should be what it taught us, if anything, about airpower. And how can these lessons be transcribed for the era of *aerospace* power?

Drew Middleton gives proper credit to the role of technology. He recounts the story of H. T. Tizard and his Aeronautical Research Committee and how it sought help from Sir R. A. Watson-Watt. In early 1935 this genius, whose biography may be the most important piece of literature bearing on the subject, wrote a memorandum outlining an idea. Something was done about it. When the war came there were twenty radar stations in Great Britain. This resulted from what is known in the trade as a technological breakthrough. Other examples are the atomic bomb, Sputnik, and if you please, the B-70 Mach 3 bomber. There are other examples in the Middleton book that

(Continued on following page)

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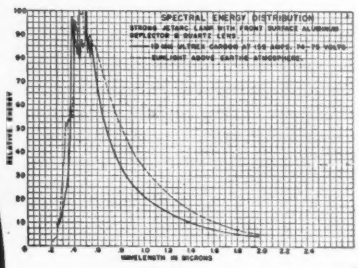

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will strike response with those who remember the early days of the war. One is his reference to the night fighters as "the most reliable killers of German bombers." Like Britain, the United States came forth in this area with too little, too late. The Germans showed the British, and the Japs showed us, that the night fighter was something we could not ignore.

There is serious debate under way today in sophisticated circles over the efficacy of air defense, active or passive. Alexander McKee quotes a writer of 1938 who proclaimed that when the next war got under way "politicians, men, women, and children, will be exterminated by the million." He wrote with finality: "That fact is known."

In 1938 he knew no more about the technology of 1940-41 than most of us know today about what research and development programs can produce for the mid-1960s. That fact also is known.

ABOUT THE REVIEWER: *Mr. Witze is Senior Editor of* AIR FORCE/SPACE DIGEST.

Scientific Personnel Problem

***Scientists in Government*, by Dr. Earl W. Lindveit (Public Affairs Press, 1960, 84 pp., $3.25)**

Reviewed by William Leavitt

In an age of science explosion, the involvement of the federal government in scientific research, basic and applied, is of ever-increasing significance, yet a careful look at government procedures in scientific manpower problems ranging from personnel inventory and recruitment to pay scales and retention suggests that the federal government has not developed policies geared to meeting the national need for unhampered and steady technological advance.

In fact, writes Dr. Lindveit, a member of the staff of the Senate Committee on Aeronautical and Space Sciences, in his concise study of scientific personnel policy problems:

"On the basis of . . . significant information available relating to the development, nature, and extent of the problem of retaining scientific personnel in federal employment, it does not appear that government efforts reflect a unified structure or specific policy direction in dealing with the full range of scientific manpower activities. There has not been demonstrated an ability to appraise over-all the full extent and possible consequences of the retention problem; only partial measures have been taken to provide the kinds of information necessary in formulating policies to meet present and future scientific manpower requirements.

"Such policy considerations," Dr. Lindveit adds, "should include the possibility that the government, if it is to be limited in meeting in an adequate manner the competition for highly skilled scientists, should be divested of the direct performance of an increased number of its science programs, with actual operations being conducted by industry, educational institutions, and other private research facilities under contract to the government."

Dr. Lindveit's little book, scarcely hammock reading, but worthy homework for the congressmen and others who have the responsibility of charting government science policies (and who wonder at the higher scientists' salaries in industry or contract-research centers), is solid with history and analysis of federal efforts to meet scientific personnel problems. The evidence presented by the author, a political scientist who has specialized in government-science relationships, suggests the difficulties of creating adequate government science programs in a free and pluralistic society where, ironically, the government must compete in the open market for the best people, and where often the government, by its bureaucratic nature, its fiscal, organizational, salary, and seniority rigidities, is often the loser in the search for talent.

Answers to such a complex problem cannot come overnight. But Dr. Lindveit urges that a start be made now in finding the answers. A first and vital step would be a soul-searching analysis by the government of its and the nation's scientific manpower needs, and a concurrent examination of the outmoded philosophies and procedures which have so often bogged down progress. It may well be that the government ought to farm out almost all of its research activity, because of the greater flexibilities of outside agencies. Or it may be that reform of civil service salary and other procedures, funding methods, and the like, can spark new life in the existing government science structure. Whatever the case, Dr. Lindveit stresses, now is the time to examine the present system critically, decide on goals, and create a broad policy for the space age.

ABOUT THE REVIEWER: *Mr. Leavitt is an Associate Editor of* AIR FORCE/SPACE DIGEST.

A Book for the "Birds"

Aerial demonstration teams have been a part of military airpower for more than three decades. In the '30s, for example, Lt. Claire Chennault led the Air Corps Tactical School's "Men on the Flying Trapeze," a quartet of AF pilots in Boeing P-12Cs. In 1936 they were replaced by the "Skylarks" who toured the country performing informally; official aerobatics were forbidden at the time. Competing for audiences in those early days were the well known Navy "Hell Divers," predecessors of the "Blue Angels" today.

Recent AF teams include USAFE's "Skyblazers" (F-86Fs); ADC's "Sabre Knights" (F-86Ds); and the Colorado ANG's "Minutemen" (F-86Hs). Best known are the USAF "Thunderbirds," who this year alone will display their precision flight techniques in their F-100Fs on more than seventy occasions to audiences in America and overseas. Since the "Birds" organized in 1953 they have performed in more than forty countries to an estimated total audience of forty million awe-inspired spectators.

The story of this incredible AF unit is now told in full length by Martin Caidin in *Thunderbirds!* (Dutton, hard cover, $4; Dell, paperback, 50¢). This is a dramatic, detailed, and intimate portrait of men, equipment, operations—a kind of prolonged on-the-spot report by Caidin, who lived and flew as a passenger with the "Birds" while researching the book.

A sad postscript to the book was written when team leader Maj. Bob Fitzgerald and team narrator Capt. George Nial crashed on the Nevada desert shortly after its publication. During the writing, an earlier crash took the life of team member Capt. Dick Crane.

War and Peace

Cameraman, by Jerry J. Joswick and Lawrence A. Keating (Chilton, $3.95), provides a lens-view of World War II in Europe. It also relates the interesting career of a wartime AAF combat photographer. TSgt. Jerry Joswick, coauthor, participated in many major missions, including the low-level Ploesti strike where he shot the only movie footage of the raid and was the sole surviving cameraman.

Sequences cover a variety of experiences such as a piggy-back P-40 photo sweep; substituting for an injured waist gunner on a B-24; strikes out of North Africa; D-Day; the air offensive over France and Germany.

Prose and verse spanning several centuries from Leonardo da Vinci to Neville Shute is collected in *The Saga of Flight,* edited by Neville Duke and Edward Lanchbery (John Day, $5.95). The editors are British; the volume leans heavily on English writing.

American air topics and authors are included in this US edition. Organized in a loose chronological fashion, the material is heavy on the early period and the literature of war, extremely light on modern flight—an area which many anthologists fail to mine properly for one reason or another.

To the missile and space oriented public mind today, the great German Zeppelin air raids on London during World War II seems unreal, almost fictitious. Yet, at that time, the raids were quite terrifying. They were the first attempt at strategic bombardment, the first attempts to undermine directly the civilian will to resist. The story is unfolded in *Zeppelins Against London,* by Kenneth Poolman (John Day, $4.50). The first serious Zeppelin strike took place on May 31, 1915, killing seven and injuring thirty-five British civilians, with $100,000 damage. By 1917, fairly heavy 660-pound bombs were in use.

Poolman writes with light and easy prose of the Zeppelin offensive, the RAF defensive air tactics which took a high toll of the great gas bags, and of the civil defense measures which were hurriedly organized by the British.

—Maj. James F. Sunderman, USAF

The story of man's conquest of the air—from Leonardo da Vinci to the Guided Missile

The Saga of Flight

Edited by **NEVILLE DUKE** and **EDWARD LANCHBERY** both of whom flew with the RAF during World War II.

An anthology of writing by and about airmen and their flights — including the first aerial voyage in Montgolfier's balloon (powered by burning straw), Anthony Fokker's first loop the loop in a plane he had constructed, von Richtofen's last dog fight, and the thirty historic seconds over Tokyo. "Pappy" Boyington writes the story of the mounting tension of his last missions; William Lundgren describes his "moment of anxiety" while testing the Bell X-1A.

"A *must* for those interested in aviation." — Virginia Kirkus

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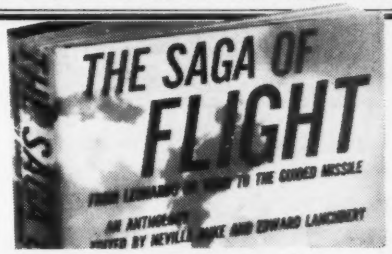

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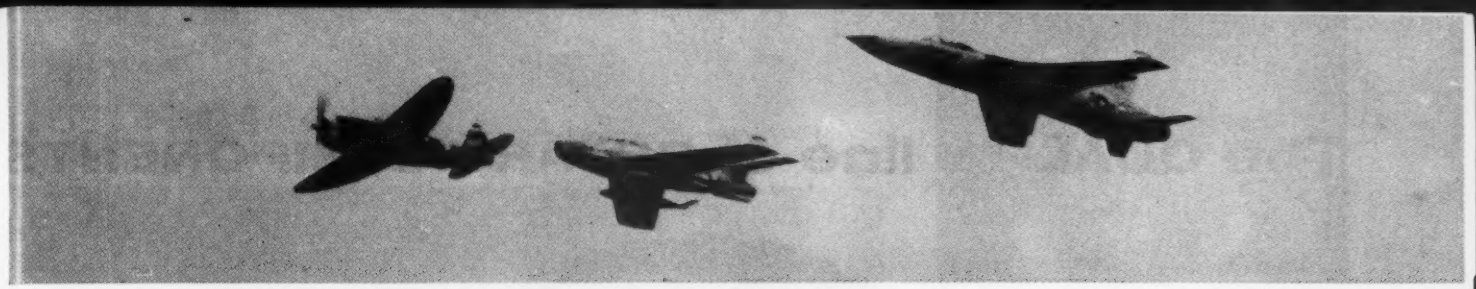
May 2 marked the twentieth anniversary of the first flight of the P-47 Thunderbolt, or "Jug." Hundreds of wartime P-47 pilots commemorated the occasion at a nostalgic reunion in New York

BACK IN THE JUG . . .

Wartime P-47 Thunderbolt at work. It has just destroyed a Nazi ammo dump in a slashing fighter-bomber attack.

Jug's anniversary featured old-buddy fellowship (above), airshow starring old P-47 at top. Leading P-47 ace Bob Johnson greets aircraft's civilian owner-pilot, Bob Bean.



Old and new in airshow. Left to right, P-47 Thunderbolt, F-84F Thunderstreak, F-105 Thunderchief run through their paces for pilots at the Jug gathering.

Aces in front of P-47. Rear row from left are Lt. Col. Randall Hendricks, John Lolos, Michael Gladych, Brig. Gen. Donald J. Strait, M. R. Paisley, Michael Jackson, Maj. Steve Pisanos, Col. Jack Donaldson. Kneeling are Maj. Marvin Grant, Col. Gerald W. Johnson, Robert S. Johnson, Lt. Col. James C. Stewart, and Donald Y. Whinnem. P-47 aces at reunion, fifteen in all, shot down total of 176 Axis planes among them in wartime fighting around the world.

AFTER TWENTY YEARS

THE P-47 Thunderbolt was one of the workhorse fighters of World War II. Rugged, fast, well armed for its day, the "Jug" played a conspicuous role in smashing the Axis from the Mediterranean to the Southwest Pacific. Army Air Forces P-47 jockeys amassed a staggering destruction-record both in attacks on enemy ground forces and in air battles. From D-Day to V-E Day in the European theater alone, P-47 dive-bombing and strafing attacks took this toll of German ground equipment: 86,000 railroad cars, 9,000 locomotives, 68,000 motor transports, 6,000 armored vehicles and tanks, 60,000 horse-drawn vehicles destroyed or damaged. P-47 support of Allied ground troops was devastating. In one instance late in the war, a German ground unit commencing a counter-offensive actually surrendered when an element of Jugs appeared overhead preparing to swoop to the attack.

Also casualties of P-47 fire were 11,874 German, Japanese, and Italian aircraft. About half were destroyed on the ground, half in the air. In all, some 10,000 P-47s were committed to action throughout the world. Enemy air and ground fire destroyed about 2,500 of these.

Today, the P-47 and its war are long past. A few '47s exist as relics in this country, a few are flown by overseas air forces. But the old snub-nosed, chunky, tough, beautifully ugly Jugs remain very much alive in the memories of thousands of American and Allied airmen who flew and fought in them. On May 2, the twentieth anniversary of the P-47's first flight, 873 former Thunderbolt pilots gathered in New York to mark the occasion. They ate and drank, talked of the old days and the new, renewed friendships, heard a few informal talks—and most of all paid their nostalgic respects to the Jug and the gallant outfits that flew it to wartime victory. Republic Aviation, which produced more than 15,000 of the planes during the war, was host to the airmen at an all-day program that included an airshow at Republic's Farmingdale, Long Island, plant. The star of the show was—yes, an aging but still spry P-47.

The pilots, who included a number of top USAF officers, came from forty-five states and three foreign countries to join in the festivities. Among them were fifteen World

(Continued on page 121)

Reunioners lunched in circus-type tent prior to three-plane airshow.

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Banquet climaxing day began with a rousing rendition of Air Force Song. Pilots cheered long and loud. Band played a series of wartime favorites.

War II P-47 aces. They were credited with a total of 176 enemy aircraft shot down among them. Top man among these was Robert S. Johnson, with twenty-eight wartime victories, an AFA Past President and now customer-relations manager for Republic. Others included Col. Fred J. Christensen, Massachusetts Air National Guard, with twenty-three victories; Col. Gerald W. Johnson, now serving in SAC at Offutt AFB, Neb., who shot down eighteen enemy planes; and Brig. Gen. Donald J. Strait, New Jersey Air National Guard, credited with thirteen and a half victories. General Strait and Bob Johnson are now AFA National Directors. The roster of those attending reads like a cross-section of wartime fighter units in the ETO and Pacific. They converged on Republic on the morning of May 2.

At lunch in a circus-type tent, a Republic official read a series of letters and wires greeting the P-47 pilots. One was from Gen. Carl Spaatz, USAF (Ret.), first USAF Chief of Staff, another from Gen. O. P. Weyland, former head of Tactical Air Command. Then came a series of introductions: Gen. Marshall Roth, USAF (Ret.), the first Army Air Forces pilot to fly the P-47; Republic's L. L. Brabham, test pilot who was at the controls on the first Jug flight; Thunderbolt designer Alexander Kartveli, now head of Republic research and development; Mr. Johnson.

Next was the airshow. The P-47, an F-84F Thunderstreak, and an F-105 Thunderchief ran through their paces—in varying styles depending on age and capabilities. The P-47 used had been found by Republic on the West Coast after a lengthy search. Republic bought it from Bob Bean of Blythe, Calif., who flew it across the country late in April. Two other nonoperational P-47s were also on display. The pilots had a field day climbing in and out of the cockpits.

The hardware part of the day's activities past, the group headed into downtown New York for some serious fellowship. A reception and dinner were held at New York's Hotel Commodore, where the main ballroom was decorated with six-foot-high insignia of all the Air Forces in which the P-47 served. Over the stage was a huge painted cutout of the Thunderbolt. On the tables were little brown jugs for each pilot inscribed with: "To all those who flew the Republic P-47 Thunderbolt, after which this receptacle was named, and who journeyed to Farmingdale for its 20th birthday on May 2, 1961—Cheers!" At each place was a handsome dinner program, whose front cover was drawn by "Steve Canyon" creator Milton Caniff (part of the cover appears on page 118).

Dinner opened with the Air Force Song, followed by a loud cheer. The orchestra, Rusty Dedrick and his "Jug Stompers," followed with a musical salute to the late Glenn Miller and his Air Force band. Members of the band, all former WW II servicemen, included such notables as Peanuts Hucko, Lou McGarity, and Marty Napoleon—all of whom played with the Miller service band.

Republic Aviation was reunion host. Above, Mundy Peale, president of the company, speaks briefly to the group.

One of the highlights of the evening was a slide presentation that spanned the years from design and first flight of the P-47 through to V-E Day. They pictured some of the damage inflicted on the enemy by the Air Force, some of the pilots who did not return, and a bit of the lighter side of the war.

There were introductions of distinguished guests, words of praise for the P-47 by pilots, jokes, some old songs, claims of "firsts" by many members of units represented, and overheard conversations that ended with, ". . . Now don't forget that address, and next time you're in town call me, old buddy."

And then the Jug's twentieth birthday party was over.

—FREDERIC M. PHILIPS

Brig. Gen. Donald J. Strait of New Jersey ANG, P-47 designer Alexander Kartveli aboard a P-47 on display.

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◀ *Illustration shows artist's conception of Grumman F9F Panther operating in Korea.*

▼ *A2F-1 Intruder with total of thirty 500-pound bombs in clusters of three from wing stations.*

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